D 101.25:11-6625-2773-35
TB 11-6625-2773-35, Alignme...

TECHNICAL MANUAL

ALIGNMENT PROCEDURES

TEST STATION, ELECTRONIC EQUIPMENT AN/USM-410 (V) 2 6625-01-069-4223

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY
2 AUGUST 1982

A910095844

WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Know the areas of this equipment containing high voltage. Do not work on the equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Be careful not to contact high-voltage connections when operating this equipment. Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body. Do not be misled by the term "low voltage." Potentials as low as 25 volts may cause death under adverse conditions.

TB 11-6625-2773-35
C2

CHANGE
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC 15 August 1983

Alignment Procedures

TEST STATION, ELECTRONIC EQUIPMENT

AN/USM-410(V)2

(6625-01-069-4223)

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iii and iv	iii and iv
2-1 through 2-8	2-1 through 2-8
4-9 and 4-10	4-9 and 4-10
4-17 through 4-22	4-17 through 4-22

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

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Original . . 0 . . . 2 August 1982
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Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
Cover	2				
i - ii	0				
iii	2				
iv	0				
1-0 - 1-4	0				
2-1	0				
2-2 - 2-8	2				
3-1	0				
4-1 - 4-9	0				
4-10	2				
4-11	1				
4-12 - 4-17	0				
4-18 - 4-20	2				
4-21	0				
4-22	2				
4-23 - 4-43	0				
4-44 Blank	0				

*Zero in this column indicates an original page.

NOTICE

Disregard this notice if your test station is serial no. 67 or higher. If it is not, go to the next paragraph.

Check the ECP modification plate located on the inside of the DIU panel of the UUT station for ECP 103.

If ECP 103 is not shown on the ECP modification plate retain pages --

iii and iv
4-9 and 4-10
4-17 through 4-22

in your manual.

File this notice sheet in front of your manual for reference purposes. If this notice does not apply, discard this sheet.

A910095844A

TB 11-6625-2773-35
C1

CHANGE
NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC 15 March 1983

Alignment Procedures

TEST STATION, ELECTRONIC EQUIPMENT

AN/USM-410(V)2

(6625-01-069-4223)

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Page No.	*Change No.	Page No.	*Change No.	Page No.	*Change No.
Cover	1				
i - iv	0				
1-0 - 1-4	0				
2-1	0				
2-2 - 2-4	1				
2-5 - 2-8	0				
3-1	0				
4-1 - 4-10	0				
4-11	1				
4-12 - 4-43	0				
4-44 Blank	0				

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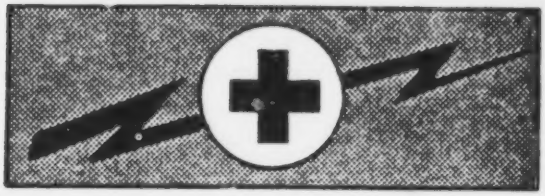
WARNING



HIGH VOLTAGE
is used in the operation of this equipment

DEATH ON CONTACT
may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Warning: Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

For Artifical Respiration, refer to FM 21-11.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE , TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

Technical Bulletin

No. 11-6625-2773-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.
2 August 1982

TECHNICAL BULLETIN

ALIGNMENT PROCEDURES

TEST STATION, ELECTRONIC EQUIPMENT AN/USM-410 (V) 2 6625-01-069-4223

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, U.S. Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703.

In either case, a reply will be furnished direct to you.

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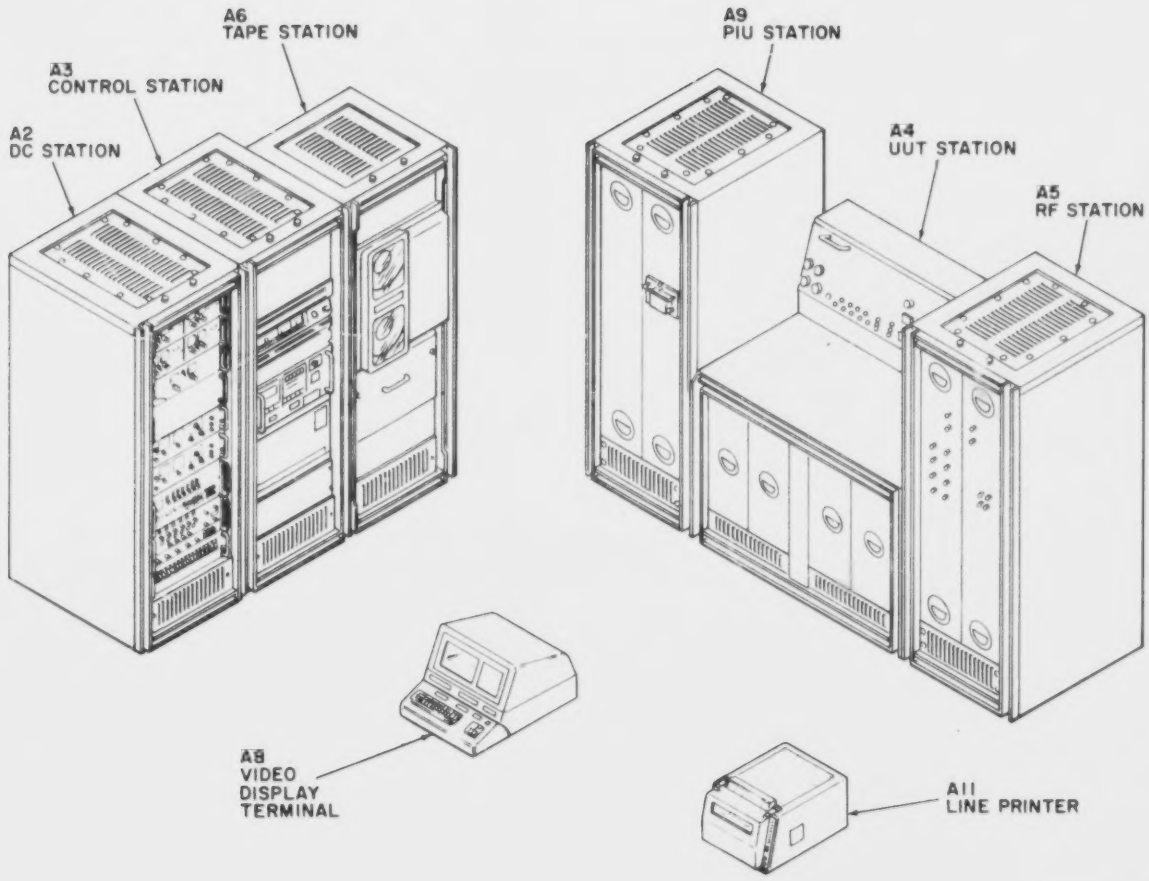


Figure 1-1. AN/USM-410(V)2 Electronic Equipment Test Station

SECTION I.

IDENTIFICATION AND DESCRIPTION

1-1. Test Instruments Identification.

The AN/USM-410(V) 2 electronic equipment test station as shown in figure 1-1, is used to verify performance and diagnose faults of electronic equipments and systems. It is a computer-controlled, programmable system capable of digital and analog generation and measurement of dc through microwave frequencies. All stimuli and measurements are programmable and make maximum use of the computer. The interface to the system for test purposes is by dedicated connectors and a single general-purpose interface connector as part of a programmable interface unit.

1-2. Alignment Description.

The test station is aligned to a set of built-in secondary standard devices which are traceable to the National Bureau of Standards. The standard devices are removed and calibrated by the TMDE Support Group (TSG) or roving calibration team. The test station is then aligned to these standards by means of resident software programs/procedures to accomplish periodic gain/offset type hardware adjustments and certain software programming correction factors.

The test station contains six (6) secondary standard devices listed in table 1-1.

Table 1-1. System Standards

Device	Part No.	Ref. Des.	TB
AC Calibrator	SM-D-869966	A2A10	
Programmable Constant Current/Voltage Calibrator	SM-C-869282	A2A9	
Frequency Standard	SM-C-868973	A4A4A1A4	
Microwave Counter	SM-D-868629	A5A2A15	
Power Meter/Head	B4003671/B4004631	A5A2A14/A5A1A20A6	
Network Analyzer	SM-D-869634	A5A2A17	

These devices are calibrated at least once every 120 days. The stimulus and measurements functions of the test station are aligned to these standards by modular software routines, which are run at shorter intervals. A software program called SYSCAL is started and provides the control and operator level instruction necessary to accomplish all alignments. The alignment modular software is listed in table 1-2.

1-3. Alignment Modules.

The accessories required to execute any or all of the alignment routines using the modular software listed in table 1-2 are included in the AN/USM-410(V) test accessory kit B4005144 (test accessories) and listed in section II. None of these accessories require specific calibration with the test station.

Table 1-2. Summary of Alignment Modules

Alignment Module No.	Name	Function
	LSVSU = LOW SPEED VOLTAGE SAMPLING UNIT. HSVSU = HIGH SPEED VOLTAGE SAMPLING UNIT.	
1	LSVSUCAL	BASIC LSVSU ADJUSTMENTS
2	MKAL/I/L	LSVSU AMPLITUDE ALIGNMENT FACTORS
3	LSVSUCAL	LSVSU DC-COUPLED 10V RANGE
4	LSVSUCAL	LSVSU DC-COUPLED 1V RANGE
5	LSVSUCAL	LSVSU AC-COUPLED 100V RANGE
6	LSVSUCAL	LSVSU DC-COUPLED 100V RANGE
7	LSVSUCAL	LSVSU AC-COUPLED 1V RANGE
8	LSVSUCAL	LSVSU AC-COUPLED 10V RANGE
9	LSVSUCAL	LSVSU AC-COUPLED 200V RANGE
10	LSVSUCAL	LSVSU DC-COUPLED 200V RANGE
11	RESCAL	LSVSU RESISTANCE OFFSETS
12	CAPCAL	LSVSU COMPLEX IMPEDANCE OFFSETS
13	LSVSUCAL	LSVSU DC AND RMS OFFSETS
14	SPARE	SPARE
15	SPARE	SPARE
*16	AMADJCAL	HSVSU ANALOG MEMORY ADJUST
*17	MKAL/L/H	HSVSU 100 KOHM PATH ADJUST
*18	PAADJCAL	HSVSU AMPLITUDE ALIGNMENT FACTORS
*19	HSOFFCAL	HSVSU RMS OFFSETS
20	HSPATHCAL	HSVSU PATH ALIGNMENT FACTORS
21	HSFREQCAL	HSVSU FREQUENCY RESPONSE ALIGN.
22	PA1000CAL	HSVSU 100 KOHM 200VP PATH ALIGN.
23	AMCAL	HSVSU AM MODULATION MEAS ALIGN.
24	FMCAL	HSVSU FM MODULATION MEAS ALIGN.
25A	PKCAL	PIU BUFFER ALIGNMENT
25B	PIU50CAL	
25C	PIUFREQCAL	
26	HSOFFCAL	+20 dB AMPLIFIER
27	FREQSTDCAL	FREQUENCY STANDARD
28	ACSTDCAL	AC STANDARD

Table 1-2. Summary of Alignment Modules - Continued

Alignment Module No.	Name	Function
	LSVSU = LOW SPEED VOLTAGE SAMPLING UNIT. HSVSU = HIGH SPEED VOLTAGE SAMPLING UNIT.	
29	DCSTDCAL	DC STANDARD
30	WFGCAL	WAVEFORM GENERATOR
31	PGCAL	PULSE GENERATOR
32	RFBCAL	RFB SYNTHESIZER
33	NRTCAL	NON REAL-TIME MEAS TIMING
34	SPARE	RESERVED
35	DCCAL	DC1 PROGRAMMABLE P.S.
36	DCCAL	DC2A PROGRAMMABLE P.S.
37	DCCAL	DC2B PROGRAMMABLE P.S.
38	DCCAL	DC3A PROGRAMMABLE P.S.
39	DCCAL	DC3B PROGRAMMABLE P.S.
40	SPARE	SPARE
41	SPARE	SPARE
42	DIUDIGCAL	DIU DIGITAL
43	PIUDIGCAL	PIU DIGITAL
44	COUNTERCAL	COUNTER
45	RESERVED	RESERVED
46	RF PROBE	RF-PROBE
47	RF PROBE	RF-PROBE
48	RF PROBE	RF-PROBE
49	SPARE	SPARE
50	SPARE	SPARE
51	MKPS	UWAVE POWER SUPPLIES
52	MKDAC1	UWAVE DACON A5A1A23A10
53	MKDAC2	UWAVE DACON A5A1A23A11
54	MKDAC4	UWAVE DACON A5A1A23A13
55	MKDAC5	UWAVE DACON A5A1A23A14
56	MKDAC6	UWAVE DACON A5A1A23A15
57	MKDAC8	UWAVE DACON A5A1A23A16
58	MKSYNPWR	RFA SYNTHESIZER POWER

Table 1-2. Summary of Alignment Modules - Continued

Alignment Module No.	Name	Function
	LSVSU = LOW SPEED VOLTAGE SAMPLING UNIT. HSVSU = HIGH SPEED VOLTAGE SAMPLING UNIT.	
59	MKGAIN500	RFA EXTENDER POWER
60	MKLEVLER	UWAVE RF LEVELER
61	MKYIG	SPARE
62	MKPHZLOK	UWAVE YIG OSC PHASE LOC
63	MKYIGMULT	UWAVE YIG MULTIPLIER
64	MKTWTLEV	UWAVE TWT LEVELER
65	MKNANAL	NETWORK ANALYZER
66	MKPH	POWER METER HEAD

*Alignment modules 16 through 19 are interdependent and are normally run as a group. If 16 is run; run 17, 18, and 19. If 17 is run; run 18 and 19. If 18 is run; run 19. 19 may be run alone.

SECTION II.

TOOLS AND TEST EQUIPMENT REQUIREMENTS

2-1. Alignment Tools and Test Equipment.

A listing of the additional tools and test equipment required to perform the operator-level alignment procedure described in section I and table 1-2 is contained in table 2-1. The test equipment must be calibrated at the specified intervals (at a minimum).

The software alignment procedures, (SYSCAL) provide the necessary instructions for connection and operation of these instruments.

2-2. Measurement Equipment.

The items in tables 1-1 and 2-1 lists the basic measurement equipment for the start of alignment routines listed in table 1-2. These instruments are used in various combinations to affect an overall measurement system, which is the most efficient for accomplishing the alignment task.

2-3. Test Equipment Deviation.

There are no deviations authorized at this time. Prior approval shall be obtained for any deviation from the list in table 2-1.

Table 2-1. Tools and Test Equipment

Reference	Device	NSN/Designation	Calibration Interval	Model
1	Digital Voltmeter	AN/USM-451	36 weeks	Ballantine 9632M
2	RF Millivoltmeter	6625-01-030-5260	40 weeks	Boonton 92BD
3	RF Signal Generator	6625-00-318-6304	25 weeks	HP 8640B
4	Oscilloscope	6625-00-127-0079	36 weeks	Tektronix 475
5	AM/FM Modulation Meter		40 weeks	Boonton 82AD
6	Power Meter		40 weeks	Gen Microwave 475A
7	Power Meter Head		40 weeks	Gen Microwave M4240A
8	Alignment Kit	5180-00-451-4540	-	GC 9200

2-4. Test Accessories.

The test accessories used for the alignment routines of the test station are listed in table 2-2 and illustrated in figure 2-1. These accessories are part of test accessory kits MK-2049/USM-410(V) and MK-2052/USM-410(V), and are contained in three transit cases. The listing in table 2-2 indicates which transit case and cavity within the transit case the accessory is located, item (accessory) reference to illustration and accessory part number.

Table 2-2. Test Accessories List

Item	Cavity Number(s)	Description	Part Number	Figure
		Transit Case No. 1, B4021292		
1	7	Cable Assembly, Special Purpose (RF) W104	B4021274	2-1, Sh 1
2	8	Cable Assembly, Special Purpose (Electrical) W106	SM-D-869185	2-1, Sh 1
3	9	Hybrid Divider/Combiner	SM-C-943722	2-1, Sh 1
4**	3	Cable Assembly, Special Purpose (RF) W102	B4021272	2-1, Sh 1
5	Cover	Probe, Active consisting of:	SM-C-855100	2-1, Sh 1
5A	Case	Attenuator Head, 100X	-	2-1, Sh 1
5B	Case	Attenuator Head, 10X	-	2-1, Sh 1
5C	Case	Tip, Probe, Retractable Hook	-	2-1, Sh 1
5D	Probe	Probe, Active	-	2-1, Sh 1
5E	Case	Insulator, Contact Ground	-	2-1, Sh 1
5F	Probe	Sleeve, Insulating (2)	-	2-1, Sh 1
5G	Case	Adapter, Probe Tip to Test Point Jack	-	2-1, Sh 1
5H	Case	Contact, Electrical Ground	-	2-1, Sh 1
5J	Case	Clip, Electrical, Alligator, Miniature	-	2-1, Sh 1
5K	Case	Lead, Electrical Ground, 12 Inch	-	2-1, Sh 1
5L	Case	Tip, Probe (3)	-	2-1, Sh 1
5M	Case	Holder, Probe	-	2-1, Sh 1
6	5	Cable Assembly, Special Purpose (RF) W103	B4021273	2-1, Sh 1
7	10	Cable Assembly, Special Purpose (RF) W101	B4021271	2-1, Sh 1
8	11	Cable Assembly, Special Purpose (RF) W105	B4021275	2-1, Sh 1
9	25	Probe Accessory Kit consisting of:	SM-C-869301	2-1, Sh 1
10	25	Probe, Needle Tip (2)	-	2-1, Sh 1
11	25	Adapter, Pin Tip (2)	-	2-1, Sh 1
12	25	Connector, Male (2)	-	2-1, Sh 1
13	25	Adapter, Spade Lug (2)	-	2-1, Sh 1
14	25	Clip, Insulator (2)	-	2-1, Sh 1
15	25	Clip, Alligator (2)	-	2-1, Sh 1
16	25	Splice, Female Plug (2)	-	2-1, Sh 1
17	16,20,23	Adapter, Tee, BNC	UG274B	2-1, Sh 1
18*	19	Fixed Short, Coaxial, Type N	SM-C-869608	2-1, Sh 1
19*	21	Cable, Coaxial Test	SM-D-869606	2-1, Sh 1
		Transit Case No. 2, B4021293		
20	9	Adapter Assembly (PIU Calibration)	SM-E-943704	2-1, Sh 2
21	16	"Minigrabber" (Clip) to Inline Banana Jack-Black	B4005297-2	2-1, Sh 2

Table 3-1. Test Accessories List - Continued

Item	Cavity Number(s)	Description	Part Number	Figure
		Transit Case No. 2, B4021293 - Continued		
22	10	"Minigrabber" (Clip) to Inline Banana Jack-Red	B4005297-1	2-1, Sh 2
23	3	Adapter, BNC Jack/Pin Tip Plugs	SM-C-943622	2-1, Sh 2
24	4	Cable Assembly, Special Purpose (RF) W107	B4021258	2-1, Sh 2
25	5,6	Adapter, OMQ Plug/BNC Jack	SM-C-943723	2-1, Sh 2
26	8	RF Short BNC Plug	SM-C-943721	2-1, Sh 2
27	11,12	Attenuator, Feed-Through Terminator 50 ohms	SM-C-943616	2-1, Sh 2
28	14	Adapter, BNC Jack Dual Banana Plug	SM-C-943624	
29	17	Extender Board, High Speed Sampler	B4003685	2-1, Sh 2
30	13	Adapter, DIU Assembly	B4003689	2-1, Sh 2
		Transit Case No. 3, B4021294		
31	10,12	Extender Board, One to One	SM-E-943686	2-1, Sh 3
32	13	Probe Kit, Voltage consisting of accessories:	SM-C-869189	2-1, Sh 3
33	2	Lead, Ground with Alligator Clip	-	2-1, Sh 3
34	2	Cap, Insulator (2)	-	2-1, Sh 3
35	2	Tip, Hook	-	2-1, Sh 3
-	6	Insert Case No. 1 ▲ :	B4021327	2-1, Sh 3
36	8, 13▲	Adapter, BNC Plug to Plug	UG491A/U	2-1, Sh 4
-	7	Insert Case No. 2 ■ :	B4021329	2-1, Sh 3
37*	9, 11■	Adapter, SMA Jack to Jack	B4005171	2-1, Sh 4
38*	8, 10■	Adapter, TNC Plus to BNC Jack	B4005296	2-1, Sh 4

*Items part of test accessory kit MK-2052/USM-410(V). All other items are part of test accessory kit MK-2049/USM-410(V).
**One cable assembly, special purpose (RF) W102 part of test accessory kit MK-2049/USM-410(V).
**Four cable assemblies, special purpose (RF) W102 part of test accessory kit MK-2052/USM-410(V).
▲Cavity number(s) located in insert case no. 1 of transit case no. 3.
■Cavity number(s) located in insert case no. 2 of transit case no. 3

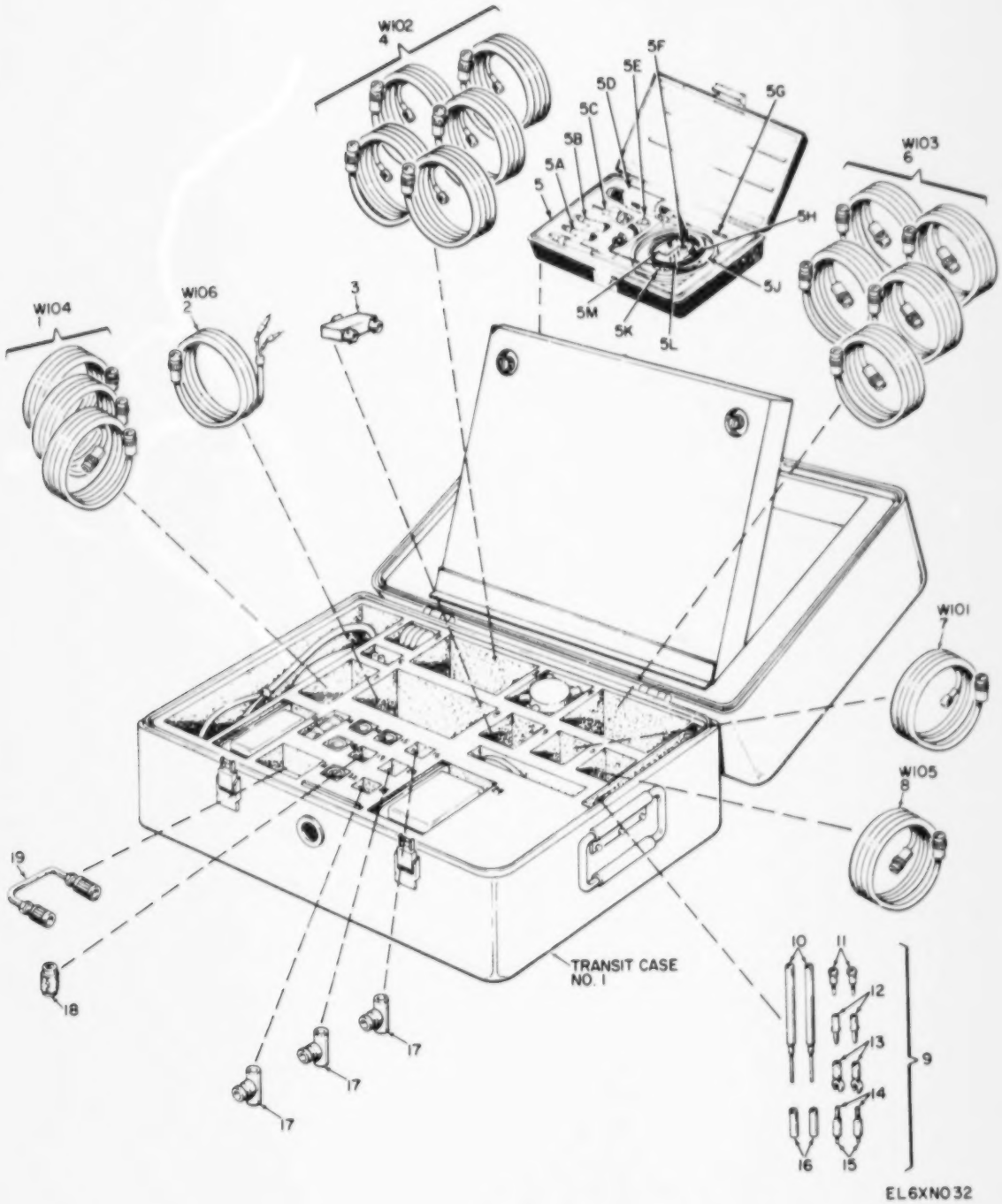


Figure 2-1. Test Accessories (Sheet 1 of 4)

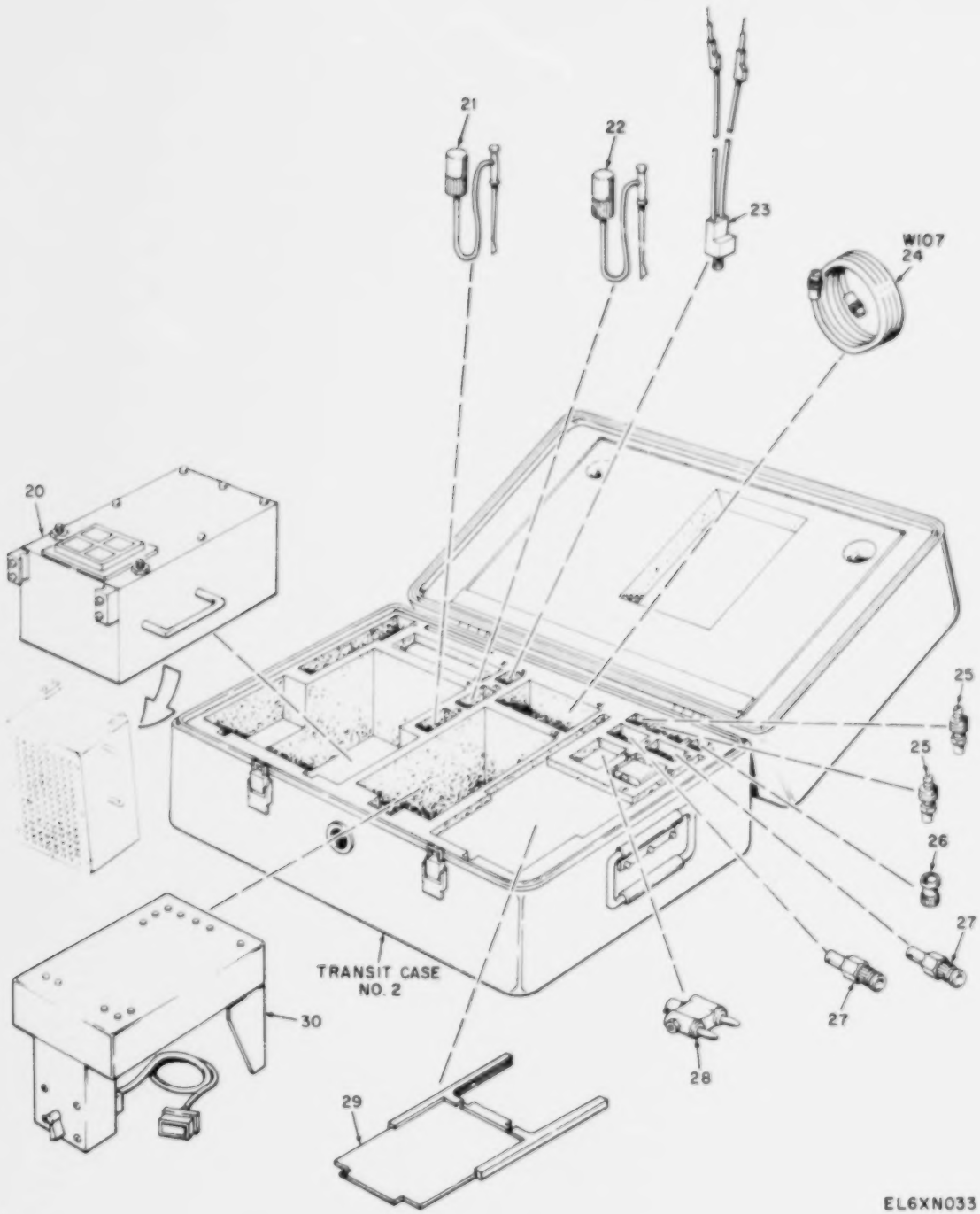


Figure 2-1. Test Accessories (Sheet 2 of 4)

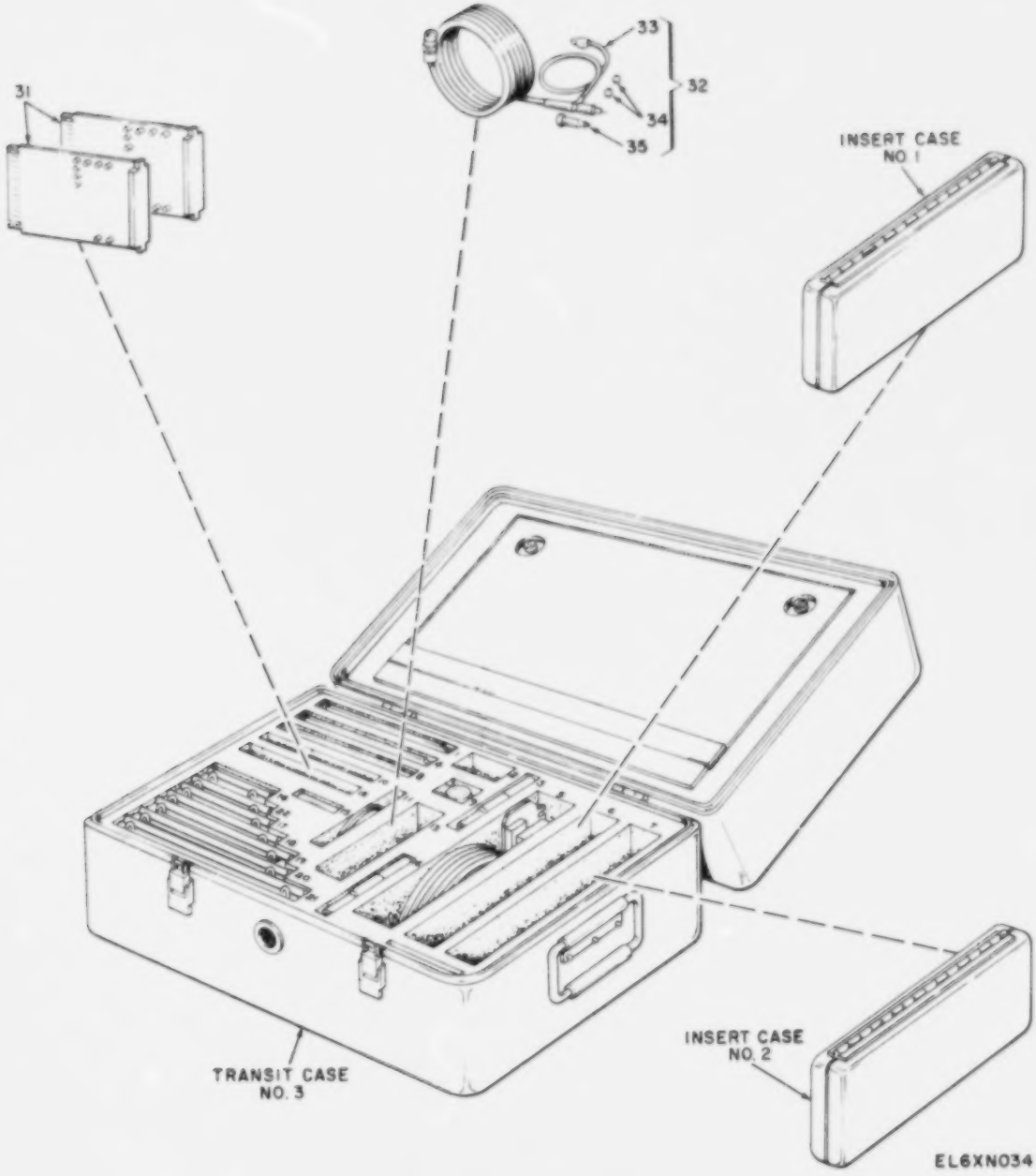


Figure 2-1. Test Accessories (Sheet 3 of 4)

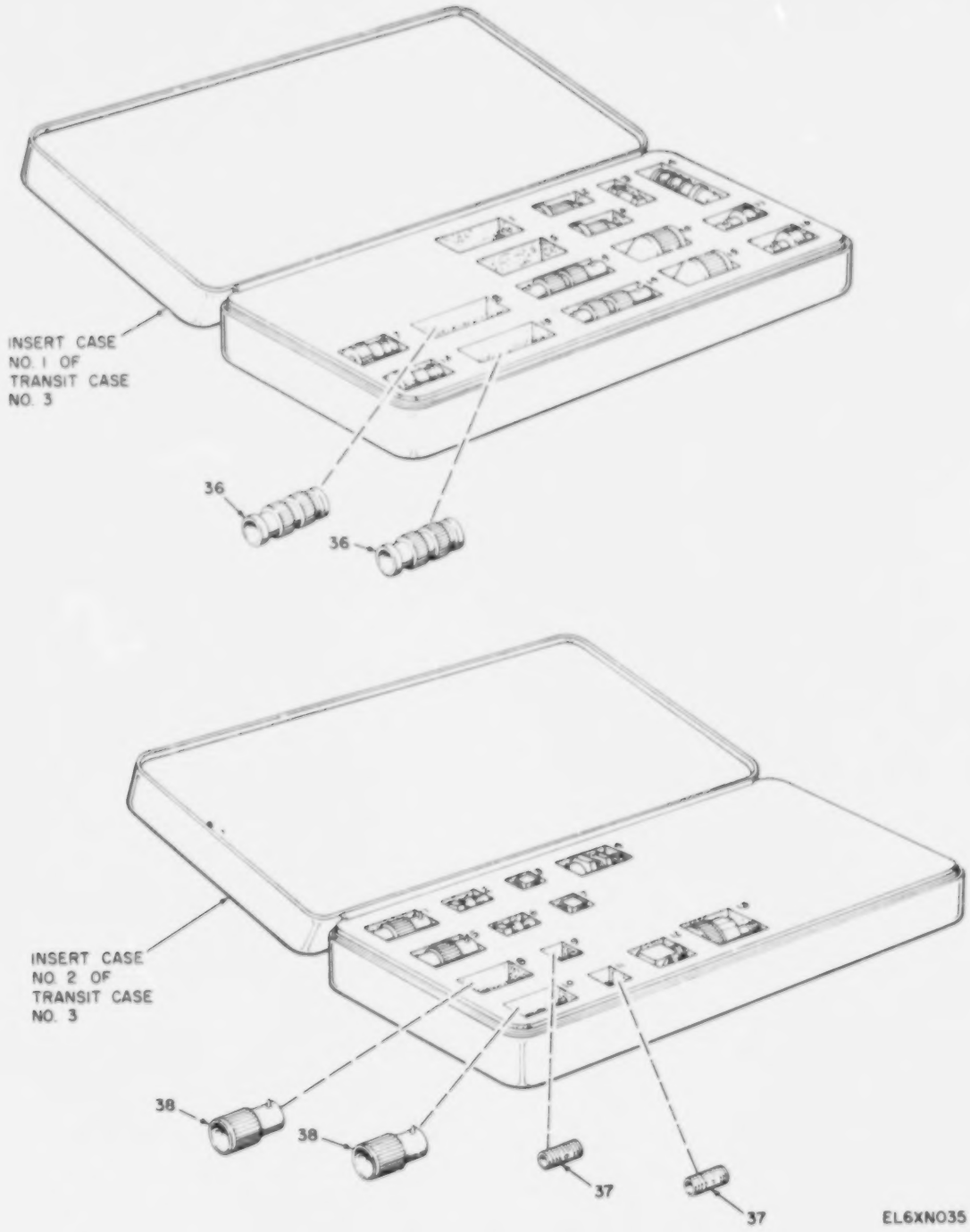


Figure 2-1. Test Accessories (Sheet 4 of 4)

SECTION III.

PRELIMINARY OPERATIONS

3-1. General.

The standard devices listed in table 1-1 shall be removed from the system to be calibrated at the specified intervals. The removal and replacement instructions for these devices are contained in TM 11-6625-2773-12 operation and maintenance manual. The warmup and instrument connections are contained in separate calibration procedures provided by TSG.

The system alignment procedures shall be performed in accordance with the instructions in this manual. Prior to attempting any alignments, the test station shall be powered up for two hours and as described in TM 11-6625-2773-12. The system test accessory kit B4005144 listed in table 2-2 is required. All cabling to the system interface DIU or PIU should be removed. Instrumentation and connection instructions for the start of the specific alignment procedures are presented to the operator by the printer/video terminal; operating instructions are also given by the video terminal.

3-2. Familiarization.

Read and become familiar with the alignment procedures and adjustment locations contained in this manual prior to beginning the alignments.

3-3. Special Environmental Conditions.

The environmental conditions listed in table 3-1 must be maintained during the alignment procedures. The conditions for calibration of the devices listed in table 1-1 will be defined in the procedures relevant to calibration by AMCC.

3-4. Test Jigs and Fixtures.

No special test jigs or fixtures are required to perform any of the alignment procedures. Those items which are required are contained in the test accessory kit provided with the test station.

Table 3-1. Environmental Conditions

Condition	Parameter
Relative Humidity	20 - 70%
Ambient Temperature	65°F to 75°F (18°C to 24°C)

SECTION IV.

ALIGNMENT PROCEDURE

4-1. General.

This section provides all the information necessary for alignment of the AN/USM-410(V) system. The alignment procedures are supplied in the form of software programs, which provide at the time of execution, all necessary information and instructions to the operator. Paragraph 4-2 presents a basic overall description of the alignment software for informational purposes only. Paragraph 4-3 presents a description of the operational aspects of the alignment software. Paragraph 4-9 contains directions for executing and maintaining the system alignment and includes tables and figures that will assist the user in locating alignment components.

4-2. Alignment Software Description.

a. Modularization. The alignment software has been designed and implemented in modular fashion. System alignment requirements have been identified for each separate system function or hardware group, and a separate program has been written for each. Rather than one large program, there are individual programs each with a unique task.

b. The Concept of Hardware and Software Alignment. Alignment of the AN/USM-410(V)2 is accomplished using traditional types of hardware adjustments and alignments in combination with software alignment factors and curves. The basic difference between the two types is that hardware alignment immediately adjusts the system performance to conform to a certain measurement or stimulus standard, whereas software alignment stores knowledge about performance that is later used to modify system programming (or processing) of a function. The latter can be considered a type of feedback, applied at the time of use.

c. The Single Control Program: SYSCAL. The module SYSCAL is a control program acting as a single control point from which any or all alignments may be made. The user enters SYSCAL on the VDT keyboard and then responds to questions. The options are:

(1) Report status of all alignment modules
(2) Automatically run those requiring re-alignment
(3) Run any module the user chooses
(4) Ask for information or help.

SYSCAL has the ability to examine the contents of each data module in the alignment data file and determine which modules are due for realignment and the amount of time remaining on all other modules. This information is output on the system printer for each module. When execution of a module is completed, control always returns to SYSCAL so that the user may choose another option or terminate the program.

d. Data Storage. Automated alignment requires a system that "remembers" information about previous alignments. For example, to know the date of last alignment or to apply an alignment curve, there must be a defined way of storing and retrieving data. SYSCAL.DA has been implemented for this purpose. SYSCAL.DA is a single file structured in a modular fashion in which data module number 1 corresponds to alignment module number 1, etc. For each alignment module, it provides for the storage of a comment or title, date of last alignment cycle time, date of an unsuccessful attempt (if any), and up to 40 alignment software factors. Since each module has the same basic structure, retrieval of data can be accomplished by a single software procedure. The input of data to SYSCAL.DA is fully automatic and is handled by each alignment module. The operator is not required to input data directly.

e. Application of Data. Another feature of the alignment is that the run-time system (RTS) automatically accesses alignment factors within the data and applies corrections for improved performance. For instance, if a particular stimulus function has a response that drops off as frequency increases, data is stored which defines a curve depicting the fall-off. When the stimulus is applied, the curve is read; and, through software, the hardware programming is modified in order to flatten the stimuli response.

4.3 Operational Description.

a. Modes of Operation. Execution of alignment is started by entering SYSCAL on the VDT keyboard. Several options are then given to the user. These include Automatic Mode, Manual Mode, Run-All Mode, Status Mode, Information Mode and Microwave Mode. After a mode is chosen, SYSCAL enters the correct alignment module and starts the module program.

b. Automatic Mode. When this mode is chosen SYSCAL starts, in order of ascending numbers, each module which is due for re-alignment. The automatic mode has two submodes. The operator may choose to run all required modules, or only those which do not require external test equipment.

c. Manual Mode. When this mode is chosen, the operator may select any alignment module by simply entering the module number when asked. When the module is completed, another may be entered and run.

d. Run-All Mode. This mode forces every module to automatically run in sequential order. Normally this mode is used only when the system is first built and integrated. The operator may input a starting module number so that alignment continues where previously halted.

e. Status Mode. This mode allows the operator to examine the overall status of the system alignment and calibration modules. When chosen, it will determine the current status of each module and print out a full report. The information shown for each module includes:

(1) A description of the function and the number of days remaining in the calibration cycle.

(2) The cycle time of each function.

(3) A message stating *** Requires Recalibration *** when the cycle time is exceeded.

(4) A message stating that an aborted run has been made if an alignment has been unsuccessful.

When the status output is complete, control returns to 'SYSCAL' and another mode may be selected.

f. Information Mode. When this mode is selected, information to assist the operator in the system is printed out. The information is similar to that written in this section. At the completion of information, control returns to SYSCAL and another mode may be selected.

g. Microwave (RF) Mode. When this mode is selected, the operator may run those alignments associated specifically with the rf station A5.

4-4. Alignment Cycle Times.

The alignment cycle time for the system as a whole is every 120 days. The majority of modules, therefore, have a 120-cycle time. Some system functions, however, require a more frequent cycle and others may be run less frequently. The cycle time for each module is shown on the printout which is output when the status mode (see paragraph 4-3 e.) is selected.

4-5. Warnings.

At the start of each test program, the run-time system checks for the presence of the alignment data file and for the status of each module. If the data file is missing, or if any module's cycle time has expired, a warning is issued to the operator. If alignment is being postponed, the operator may push the PROCEED button and continue the test. If alignment is to be run, the operator must push proceed, push HALT and then run SYSCAL.

4-6. Alignment Data File.

All alignment data is contained in files titled SYSCAL.DA and VWAVECAL.DA. Since these files are dynamic, their contents are continuously changing and cannot be kept on the SYSTEM SOFTWARE tape that is supplied with each system. The SYSTEM SOFTWARE tape contains a copy of SYSCAL.DA which has all ideal factors and the date for each module. As each module is run, this data is replaced with "real" data.

4-7. Backup and Restoration of the Data File.

To avoid loss of valuable data, which could necessitate the realignment of the entire system, the calibration data should be backed up after any module is run.

Programs which back up and restore data are supplied with the system. (See paragraph 4-9 for operating instructions.)

4-8. Software Alignment.

Data in the system data file SYCAL.DA is normally automatically applied by the Run-Time System. Under certain circumstances, for example, when troubleshooting the system, it may be necessary to inhibit all or portions of the software alignment. The following switches are provided for this purpose:

TEST/F: Turns all software alignment off.

TEST/G: Turns only stimulus alignment off.

TEST/H: Turns only "original alignment" off. "Original alignment" refers to sampler amplitude and PIU Buffer alignments, which have always been part of the AN/USM-410(V) from its inception.

TEST/I: Turns off all measurements alignment other than "original."

TEST/E: Turns all software alignment off, except "original alignment", which is turned on (this copies an early 410 without system-wide calibration).

4-9. Operating Instructions/Procedures

a. Warning Messages. The system will inform you when an alignment should be performed by issuing a warning that a specific alignment module requires execution. This warning is issued both on the system video terminal and line printer whenever TEST UUTNAME is entered on the VDT. The form of the warning on the line printer is as follows:

```
**********************************************************************************
**         WARNING:  THE FOLLOWING ALIGNMENT MODULES REQUIRE REALIGNMENT         **
**********************************************************************************
23 24

**********************************************************************************
**         WARNING:  THE FOLLOWING ALIGNMENT MODULES REQUIRE REALIGNMENT         **
**                             DUE TO MAINTENANCE ACTIVITY                       **
**********************************************************************************
43
```

When issued, this warning will appear at the start of the execution of any test program on the AN/USM-410(V). The displayed modules must be run in order to clear the warning.

b. Initial System Alignment. The system is initially supplied with a version of the alignment data file, which has every alignment module in an expired state. To clear the warning messages for each module and to align the system hardware, it is necessary to run each alignment module in ascending order. This is done by executing SYSCAL in the run-all or automatic modes described in paragraph 4-3d. When SYSCAL requests the starting module, enter number 1.

c. Normal Periodic System Alignment. To start the system alignment, enter the command SYSCAL followed by a RETURN on the VDT keyboard. A display will appear on the VDT. Press Proceed Key (f8) on the VDT keyboard. SYSCAL then displays the modes of operation described in paragraph 4-3 and asks for one of the modes to be selected. If the alignment modules to be run are numbered less than 50 (system, less rf station), then select either the automatic or manual modes. If the modules are numbered greater than 50 (rf station), then select the microwave (rf) mode. For each module to be run, input the module number followed by a RETURN on the VDT keyboard.

Depending upon which module is being run, the operator may be required to adjust one or more potentiometers. These potentiometers are always referred to by system reference designators (for example, A4A1A2A2R2). Table 4-1 lists, on a module-by-module basis, each of these reference designators and a relevant figure included in this section. The figures will assist in locating the referenced potentiometer.

d. Backup of Alignment Data. Upon completion of a run of one or more alignment modules, the system alignment data files should be backed up on the system alignment data magnetic tape provided with each system. Use the following procedures for back up the calibration data.

(1) If the magnetic tape unit has been initialized with the INIT command, enter RELEASE MTO RETURN on the VDT keyboard.

(2) Enter BACKUPCAL RETURN on the VDT keyboard. VDT display will show:

```
====================================
CALIBRATION DATA BACKUP, REVISION X.XX
====================================

EACH SYSTEM HAS ITS OWN CALIBRATION
DATA TAPE.  MOUNT THE CALIBRATION DATA
TAPE FOR THIS SYSTEM ON THE MAG TAPE
UNIT.  MAKE SURE THE TAPE IS ON LINE.
PRESS RETURN TO CONTINUE
```

(3) Mount the desired backup tape on the magnetic tape unit. Press RETURN on VDT keyboard. VDT display will show:

```
IF YOU WANT TO STOP EXECUTION, CNTL-A NOW,
OTHERWISE FOLLOW INSTRUCTIONS.
PRESS RETURN TO CONTINUE.
```

(4) Press RETURN on VDT keyboard. Within three minutes, VDT display will show:

```
* DO NOT USE CNTL-A UNTIL THE PROGRAM HAS FINISHED. *

* DUMPING LATEST CAL DATA TO TAPE *

SYSCAL.DA
filename 1      }   These additional files
   :            }   may or may not appear.
filename n      }
   :
SYSCAL.DA
filename 1      }   These files will be duplicates
   :            }   of the previous files.
filename n      }

REMOVE CALIBRATION TAPE FOR THIS SYSTEM
AND MARK WITH TODAY'S DATE.  HH-MM-SS
PRESS RETURN TO CONTINUE.

* CAL DATA BACKUP COMPLETE *
```

(5) Enter RELEASE MTO RETURN on VDT keyboard. Unmount the backup tape from the magnetic tape unit and mark as directed. If any errors occurred, get a new magnetic tape and repeat the procedure from step (2). If no errors occurred, return to normal operation.

e. Alignment Data Backup Tapes. Two 600' magnetic tapes are used to backup the system alignment data. These tapes are used alternately when backing-up the alignment data. Always use the tape with the oldest data to back-up the new alignment data.

If one tape is lost or destroyed, restore the alignment data from alternate tape.

f. Restoration of Calibration Data. When the system calibration data files have been overwritten or lost from the DPOF system disk, the data must be reloaded from the CAL backup tape. Use the following procedure to reload the data files from the latest backup tape.

(1) If the magnetic tape unit has been initialized with the INIT command, enter RELEASE MTO RETURN on the VDT keyboard.

(2) Enter RESTORECAL RETURN are the VDT keyboard. VDT display will show:

```
============================
CALIBRATION DATA RESTORATION
============================

    THIS FILE WILL RELOAD THE SYSTEM
    CALIBRATION DATA FILE FROM THE
    SYSTEM CALIBRATION BACKUP TAPE
    (MTO:0)

    STRIKE ANY KEY TO CONTINUE
```

(3) Press RETURN on VDT keyboard. VDT display will show:

```
EACH SYSTEM HAS ITS OWN CALIBRATION
DATA TAPE.  MOUNT THE CALIBRATION DATA
TAPE FOR THIS SYSTEM ON THE MAG TAPE
UNIT.  MAKE SURE THE TAPE IS ON LINE
BEFORE PROCEEDING

STRIKE ANY KEY TO CONTINUE
```

(4) Mount the desired backup tape on the magnetic tape unit. Press RETURN on VDT keyboard. Within three minutes VDT display will show:

```
LOADING CALIBRATION DATA FROM CAL BACKUP TAPE INTO EQUATEUTIL

SYSCAL.DA      (file creation date)
filename 1     (file creation date)   } These additional files
    :                                 } may or may not appear.
filename n     (file creation date)   }

CALIBRATION DATA RESTORATION IS NOW COMPLETE
PROVIDED NO MAG TAPE ERROR MESSAGES OCCURRED.

IF NO ERRORS OCCURRED, REMOVE THE CALIBRATION TAPE.

IF ANY MAG TAPE ERRORS OCCURRED, ENTER RESTORECI
```

(5) Enter RELEASE MTO RETURN on VDT keyboard. If no errors occurred, unmount the backup tape and return to normal operation. If any errors occurred when restoring the data, proceed to step (6).

(6) Enter RESTORECI RETURN are the VDT keyboard. VDT display will show:

```
============================
CALIBRATION DATA RESTORATION
============================

    THIS FILE WILL RELOAD THE SYSTEM
    CALIBRATION DATA FILE FROM THE
    SYSTEM CALIBRATION BACKUP TAPE
    (MTO:1)

    STRIKE ANY KEY TO CONTINUE
```

(7) Press RETURN on VDT keyboard. VDT display will show:

```
EACH SYSTEM HAS ITS OWN CALIBRATION
DATA TAPE.  MOUNT THE CALIBRATION DATA
TAPE FOR THIS SYSTEM ON THE MAG TAPE
UNIT.  MAKE SURE THE TAPE IS ON LINE
BEFORE PROCEEDING

STRIKE ANY KEY TO CONTINUE
```

(8) Within five minutes the VDT display will show:

```
LOADING CALIBRATION DATA FROM CAL BACKUP TAPE INTO EQUATEUTIL

SYSCAL.DA      (file creation date)
filename 1     (file creation date)   } These additional files
    :                                 } may or may not appear.
filename n     (file creation date)

CALIBRATION DATA RESTORATION IS NOW COMPLETE
PROVIDED NO MAG TAPE ERROR MESSAGES OCCURRED.

IF NO ERRORS OCCURRED, REMOVE THE CALIBRATION TAPE.

IF ANY MAG TAPE ERRORS OCCURRED, GET THE SECOND CAL
BACKUP TAPE AND START AGAIN BY ENTERING RESTORECAL
```

(9) Enter RELEASE MTU RETURN on VDT keyboard. Unmount the backup tape. If any errors occurred, get the second CAL backup tape and return to step (2). If no errors occurred, return to normal operation.

g. Warm-Up Requirements. Performance of several of the CAL modules requires that the system be thoroughly warmed-up and thermally stable. These requirements apply to the rf station A5 and to the high speed voltage sampling unit (HSVSU) A4A3A4 as follows:

(1) Prior to performance of any of the following CAL modules: 2, 16, 17, 18, 59, 60, 61, 62, 63, 64, 65, 66, the system must first be warmed-up in accordance with TM 11-6625-2773-12. Upon completion of the warm-up program*, a minimum time of one hour additional warmup is necessary prior to performance of the above listed modules.

(2) In the special case of CAL module 18, the additional one hour warm-up may be bypassed if desired. However, this module must then be re-run after one hour to correct the stored alignment factors because of the increased temperature of the HSVSU.

4-10. PIU Alignment.

a. General. Alignment module number 25 is for alignment of the PIU measurement paths. Module number 25 is composed of three sub-modules.

---

* If the HSVSU or rf station are severely out of alignment (or a component has been replaced in these units) the warm-up program may not be able to pass the HSVSU or RF tests. In such cases it may be necessary to align HSVSU (modules 16-19) or the rf station (modules 51-66) prior to running WARMUP. See TM 11-6625-2773-12 for warm-up instructions.

b. Description.

(1) Module 25A (PKAL). This module aligns the buffer amplifier on each of the 128 test points in the system. Three gain and one offset reading is taken on each test point. It takes approximately 10 minutes to complete a total run of 128 test points.

(2) Module 25B (PIU50CAL). This module aligns the frequency response of the high attenuation buffer path (divide by 50 path) of each test point. It takes approximately 15 minutes for this module to run completely.

(3) Module 25C (PIUFREQCAL). This module aligns the high frequency response (10 MHz) of each test point. Six readings per test point (TP) are taken. External test equipment (Boonton RF millivoltmeter NSN 6625-01-030-5260) is required. It takes approximately 1.6 minutes per test point to run. To run all 128 test points requires approximately 3 1/2 hours.

c. Instructions. Whenever a DUTP (dual universal test point) is replaced in the PIU, it must be re-aligned. This is done by typing SYSCAL on the VDT keyboard and then selecting module number 25. Sub-module 25A and 25B will run in their entirety. Sub-module 25C will ask whether you wish to run the whole PIU or just specific test points. Always select the option for specific test points (manual mode), and then run only the TP(s) which correspond to the DUTPs that have been replaced as described in paragraph 4-10d. Sub-module 25C is run in its entirety only prior to deployment, if calibration data on back-up tape is lost, or if the PIU has undergone major overhaul.

d. PIU DUTP (Dual Universal Test Point) to TP Conversion. The 128 PIU test points are contained on 64 DUTP pc boards. There are two test points to each DUTP pc board. The 64 DUTP pc boards are contained in four basket assemblies (A9A2A1 through A9A2A4) with 16 DUTP pc boards in each basket assembly. The test points which are contained in each DUTP pc board are as follows:

Basket Assembly	DUTP Boards	Test Points (TPs)
A9A2A1	A9A2A1A2 thru A9A2A1A17	1 thru 32
A9A2A2	A9A2A2A2 thru A9A2A2A17	33 thru 64
A9A2A3	A9A2A3A2 thru A9A2A3A17	65 thru 96
A9A2A4	A9A2A4A2 thru A9A2A4A17	97 thru 128

(For example; DUTP pc board A9A2A1A2 is for test points 1 and 2, A9A2A1A3 is for test points 3 and 4, etc.)

Table 4-1. Adjustment/Test Point Location List

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
1	LSVSUCAL	A4A3A2A1A3 CLOCK	4-1	
		A4A3A2A1A1 OFFSET	4-1	
		A4A3A2A1A1 RANGE	4-1	
		A4A3A2A13R7	4-1	
		A4A3A2A23R7	4-1	
2	MKAL/I/L	None		
3	LSVSUCAL	A4A3A2A23R10	4-1	
4	LSVSUCAL	A4A3A2A23R12	4-1	
5	LSVSUCAL	A4A3A2A26R5	4-1	
6	LSVSUCAL	A4A3A2A23R2	4-1	
7	LSVSUCAL	None		
8	LSVSUCAL	None		
9	LSVSUCAL	A4A3A2A26R7	4-1	
10	LSVSUCAL	A4A3A2A23R4	4-1	
11	RESCAL	None		
12	CAPCAL	None		
13	LSVSUCAL	None		
14	SPARE			
15	SPARE			
16	AMADJCAL	A4A3A4A1R60 A4A3A4A1R59	4-2 4-2	

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
17	PAADJCAL	A4A3A4A4R11	4-2	
		A4A3A4A4R14	4-2	
18	MKAL/L/H	None		
19	HSOFFCAL	None		
20	HSPATHCAL	None		
21	HSFREQCAL	None		
22	PA1000CAL	None		
23	AMCAL	None		
24	FMCAL	A4A3A4A8R37	4-2	
25A	PKAL	None		
25B	PIU50CAL	None		
25C	PIUFREQCAL	None		
26	HSOFFCAL	None		
27	FREQSTDCAL	A4A4A1A4	4-4	Remove from system and calibrate in lab.
28	ACSTDCAL	A2A10	4-5	Remove from system and calibrate in lab.
29	DCSTDCAL	A2A9	4-5	Remove from system and calibrate in lab.
30	WFGCAL	A4A6R22	4-6	
		A4A6R23	4-6	
		A9A2A1A18R1	4-7	
		A9A2A1A18R24	4-7	
		A9A2A2A18R1	4-7	
		A9A2A2A18R24	4-7	
		A9A2A3A18R1	4-7	
		A9A2A3A18R24	4-7	
		A9A2A4A18R1	4-7	
		A9A2A4A18R24	4-7	
		A4A1A1A9R96	4-8	

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
30 (cont.)		A4A1A1A16R33	4-8	
		A9A2A5R22	4-9	
		A9A2A5R23	4-9	
		A9A2A3A22R1	4-7	
		A4A1A1A16R3	4-8	
		A9A2A3A22R24	4-7	
31	PGCAL	A4A1A2A8C5	4-10	Use extender board SM-E-943686
		A4A1A2A19C5		
		A4A1A2A2R2		
		A4A1A2A2R1		
		A4A1A2A4R2		
		A4A1A2A4R1		
		A4A1A2A13R2		
		A4A1A2A13R1		
		A4A1A2A15R2		
		A4A1A2A15R1		
		A4A1A2A6R14		
		A4A1A2A10R8		
		A4A1A2A10R19		
		A4A1A2A10R15		
		A4A1A2A10R36		
		A4A1A2A10R2		
		A4A1A2A10R6		
		A4A1A2A17R14		
		A4A1A2A21R8		
		A4A1A2A21R19		
		A4A1A2A21R15		
		A4A1A2A21R36		
		A4A1A2A21R2		
		A4A1A2A21R6	4-10	Use extender board SM-E-943686
		A9A2A1A18R28	4-7	Use extender board B4005348
		A9A2A1A18R27		
		A9A2A1A18R13		
		A9A2A1A18R12		
		A9A2A2A18R28		
		A9A2A2A18R27		
		A9A2A2A18R13		
		A9A2A2A18R12		
		A9A2A3A18R28		
		A9A2A3A18R27		
		A9A2A3A18R13		

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
31 (cont.)		A9A2A3A18R12		
		A9A2A4A18R28	4-7	Use extender board B4005348
		A9A2A4A18R27	4-7	Use extender board B4005348
		A9A2A4A18R13		
		A9A2A4A18R12		
		A9A2A3A22R28		
		A9A2A3A22R27		
		A9A2A3A22R13		
		A9A2A3A22R12	4-7	Use extender board B4005348.
32	RFBCAL	A4A4A3A5R14	4-11	Remove screw for access to R14.
33	NRTCAL	A4A3A4A3R10	4-2	Use extender board B4003685
		A4A3A4A3R7	4-2	
34	SPARE			
35	DCCAL	A2A5 Output Voltage	4-5	Behind front panel.
		A2A5R272 Knob on front panel	4-12	
36	DCCAL	A2A2A4 Output voltage	4-5	Adjustment access through top of unit.
		A2A2A4R272 Knob on front panel	4-13	
37	DCCAL	A2A2A3 Output voltage	4-5	Adjustment access through top of unit.
		A2A2A3R272 Knob on front panel	4-13	
38	DCCAL	A2A1A2 Output voltage	4-5	Adjustment access through top of unit.
		A2A1A2R272 Knob on front panel	4-13	
39	DCCAL	A2A1A1 Output voltage	4-5	Adjustment access through top of unit.
		A2A1A1R272 Knob on front panel	4-13	

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
40	SPARE			
41	SPARE			
42	DIUDIGCAL	A4A7A12R1	4-6	
		A4A7A12R2	4-6	
		A4A7A13R1	4-6	
		A4A7A13R2	4-6	
		A4A7A14R1	4-6	
		A4A7A14R2	4-6	
		A4A7A15R1	4-6	
		A4A7A15R2	4-6	
43	PIUDIGCAL	A9A1PS10 Upper Control	4-15	
		A9A1PS10 Lower Control	4-15	
		A9A1PS11 Upper Control	4-15	
		A9A1PS11 Lower Control	4-15	
		A9A1PS8 Upper Control	4-15	
		A9A1PS8 Lower Control	4-15	
		A9A1PS9 Upper Control	4-15	
		A9A1PS9 Lower Control	4-15	
44	COUNTERCAL	A4A3A3A13R1	4-16	
		A4A3A3A13R2	4-16	
		A4A3A3A14R1	4-16	
		A4A3A3A14R2	4-16	
45	RESERVED	N/A		
46	RF PROBE	None		
47	RF PROBE	None		
48	RF PROBE	None		
49	SPARE			
50	SPARE			
51	MKPS	A5A1A22, TB1-8/E2	4-17	Connect W106
		A5A1PS2	4-18	Adjust output control
		A5A1A22, TB1-5/E2	4-17	Connect W106
		A5A1A22, TB1-2/E2	4-17	Connect W106

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
51		A5A1PS5	4-19	Adjust output control
		A5A1PS6	4-19	Adjust output control
		A5A1PS9	4-19	Adjust output control
		A5A1PS4	4-19	Adjust output control
		A5A1PS16	4-18	Adjust output control
		A5A1PS17	4-18	Adjust output control
		A5A2PS2	4-20	Adjust output control
		A5A1A22, TB1-2/E2	4-17	Connect W106
		A5A1A22, TB1-11/E2	4-17	Connect W106
		A5A1A22, + Output/ - Output	4-19	Connect W106
		A5A1A21A23, 4/2	4-21	Connect W106
		A5A2A18A10, 25/28	4-22	Connect W106 Use extender/TP board SM-E-943686.
52	MKDAC1	A5A1A23A10R1	4-23	Adjust R1.
		A5A1A23A10R2	4-23	Adjust R2.
52	MKDAC1	YIG OSC A5A1A21A11	4-23	Connect Probe.
53	MKDAC2	YIG OSC A5A1A21A11	4-23	Connect Probe.
		A5A1A23A11R1	4-23	Adjust R1.
		A5A1A23A11R2	4-23	Adjust R2.

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
54	MKDAC4	A5A1A23A13R1	4-23	Adjust R1.
		A5A1A23A13R2	4-23	Adjust R2.
				Use Extender Board SM-E-943686.
55	MKDAC5	A5A1A23A14R1	4-23	Adjust R1.
		A5A1A23A14R2	4-23	Adjust R2.
				Use Extender Board SM-E-943686.
56	MKDAC6	A5A1A23A15R1	4-23	Adjust R1.
		A5A1A23A15R2	4-23	Adjust R2.
		YIG Filter A5A1A21A20	4-18	Connect Probe.
57	MKDAC8	A5A1A23A16	4-23	Adjust R1 amd R2.
				Use Extender Board SM-E-943686.
58	MKSYNPWR	A5A1A22A6-J3	4-23	Disconnect RF Cable
		A5A1A22A6-J3	4-23	Connect Power Meter
		A5A1A22A5R14	4-23	Adjust R14
		A5A1J1-A5A2J11	4-24	Disconnect A5W9
		A5A1J2-A5A2J12	4-24	Disconnect A5W10
59	MKGAIN500	A5A1A21R1	4-18	Adjust R1.
		A5A1A21A20	4-18	Adjust left control.
		A5A1A21A20	4-18	Adjust right control.
		A5A1A21CR20	4-23	Disconnect W46.
60	MKLEVLER	A5A1A21A17R14	4-23	Adjust control R14.
61	MKYIG	None		
62	MKPHZLOK	A5A1J1-A5A2J11	4-24	Connect and Disconnect A5W9.
		A5A1J2-A5A2J12	4-24	Connect and Disconnect A5W10.

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
51		A5A1PS5	4-19	Adjust output control
		A5A1PS6	4-19	Adjust output control
		A5A1PS9	4-19	Adjust output control
		A5A1PS4	4-19	Adjust output control
		A5A1PS16	4-18	Adjust output control
		A5A1PS17	4-18	Adjust output control
		A5A2PS2	4-20	Adjust output control
		A5A1A22, TB1-2/E2	4-17	Connect W106
		A5A1A22, TB1-11/E2	4-17	Connect W106
		A5A1A22, + Output/ - Output	4-19	Connect W106
		A5A1A21A23, 4/2	4-21	Connect W106
		A5A2A18A10, 25/28	4-22	Connect W106 Use extender/TP board SM-E-943686.
52	MKDAC1	A5A1A23A10R1	4-23	Adjust R1.
		A5A1A23A10R2	4-23	Adjust R2.
52	MKDAC1	YIG OSC A5A1A21A11	4-23	Connect Probe.
53	MKDAC2	YIG OSC A5A1A21A11	4-23	Connect Probe.
		A5A1A23A11R1	4-23	Adjust R1.
		A5A1A23A11R2	4-23	Adjust R2.

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
54	MKDAC4	A5A1A23A13R1	4-23	Adjust R1.
		A5A1A23A13R2	4-23	Adjust R2.
				Use Extender Board SM-E-943686.
55	MKDAC5	A5A1A23A14R1	4-23	Adjust R1.
		A5A1A23A14R2	4-23	Adjust R2.
				Use Extender Board SM-E-943686.
56	MKDAC6	A5A1A23A15R1	4-23	Adjust R1.
		A5A1A23A15R2	4-23	Adjust R2.
		YIG Filter A5A1A21A20	4-18	Connect Probe.
57	MKDAC8	A5A1A23A16	4-23	Adjust R1 amd R2.
				Use Extender Board SM-E-943686.
58	MKSYNPWR	A5A1A22A6-J3	4-23	Disconnect RF Cable
		A5A1A22A6-J3	4-23	Connect Power Meter
		A5A1A22A5R14	4-23	Adjust R14
		A5A1J1-A5A2J11	4-24	Disconnect A5W9
		A5A1J2-A5A2J12	4-24	Disconnect A5W10
59	MKGAIN500	A5A1A21R1	4-18	Adjust R1.
		A5A1A21A20	4-18	Adjust left control.
		A5A1A21A20	4-18	Adjust right control.
		A5A1A21CR20	4-23	Disconnect W46.
60	MKLEVLER	A5A1A21A17R14	4-23	Adjust control R14.
61	MKYIG	None		
62	MKPHZLOK	A5A1J1-A5A2J11	4-24	Connect and Disconnect A5W9.
		A5A1J2-A5A2J12	4-24	Connect and Disconnect A5W10.

Table 4-1. Adjustment/Test Point Location List - Continued

Alignment Module Number	Alignment Module Name	Adjustment/ Test Point Location	Figure Reference	Remarks
62 (cont.)		A5A1A21A1 Connector "B"	4-18	Disconnect A5W8.
		A5A1A21A6-J2	4-18	Disconnect A5A1A21W5
		X10 MULT A5A121A3C1	4-18	Adjust C1.
		A5A1A21A3C2	4-18	Adjust C2.
63	MKY1GMULT	A5A1J1-A5A2J11	4-24	Disconnect A5A1W9.
		A5A1J2-A5A2J12	4-24	Disconnect A5A1W10
		A5A1A21CR20	4-23	Disconnect A5A1A21W46
		A5A1J1-A5A2J11	4-24	Connect A5W9
		A5A1J2-A5A2J12	4-24	Connect A5W10
64	MKTWTLEV	A5A1J1-A5A2J11	4-24	Disconnect A5A1W9.
		A5A1J2-A5A2J12	4-24	Disconnect A5A1W10.
		A5A1A21CR20	4-24	Disconnect
A5A1A21W46.				
		A5A1J1-A5A2J11	4-24	Connect A5W9.
		A5A1J2-A5A2J12	4-24	Connect A5W10.
65	MKNANAL	A5A1J1-A5A2J11	4-24	Connect A5W9
		A5A1J2-A5A2J12	4-24	Connect A5W10
		A5A2J13-A5A2J14	4-24	Connect transmission line adapter
		A5A1J2-A5A2J12	4-24	Connect flex cable W103
		A5A2A17	4-20	Perform various adjustments
		A5A2J15	4-24	Connect short adapter
66	MKPH	A5A1J1-A5A2J11	4-24	Disconnect A5W9
		A5A1J2-A5A2J12	4-24	Disconnect A5W10

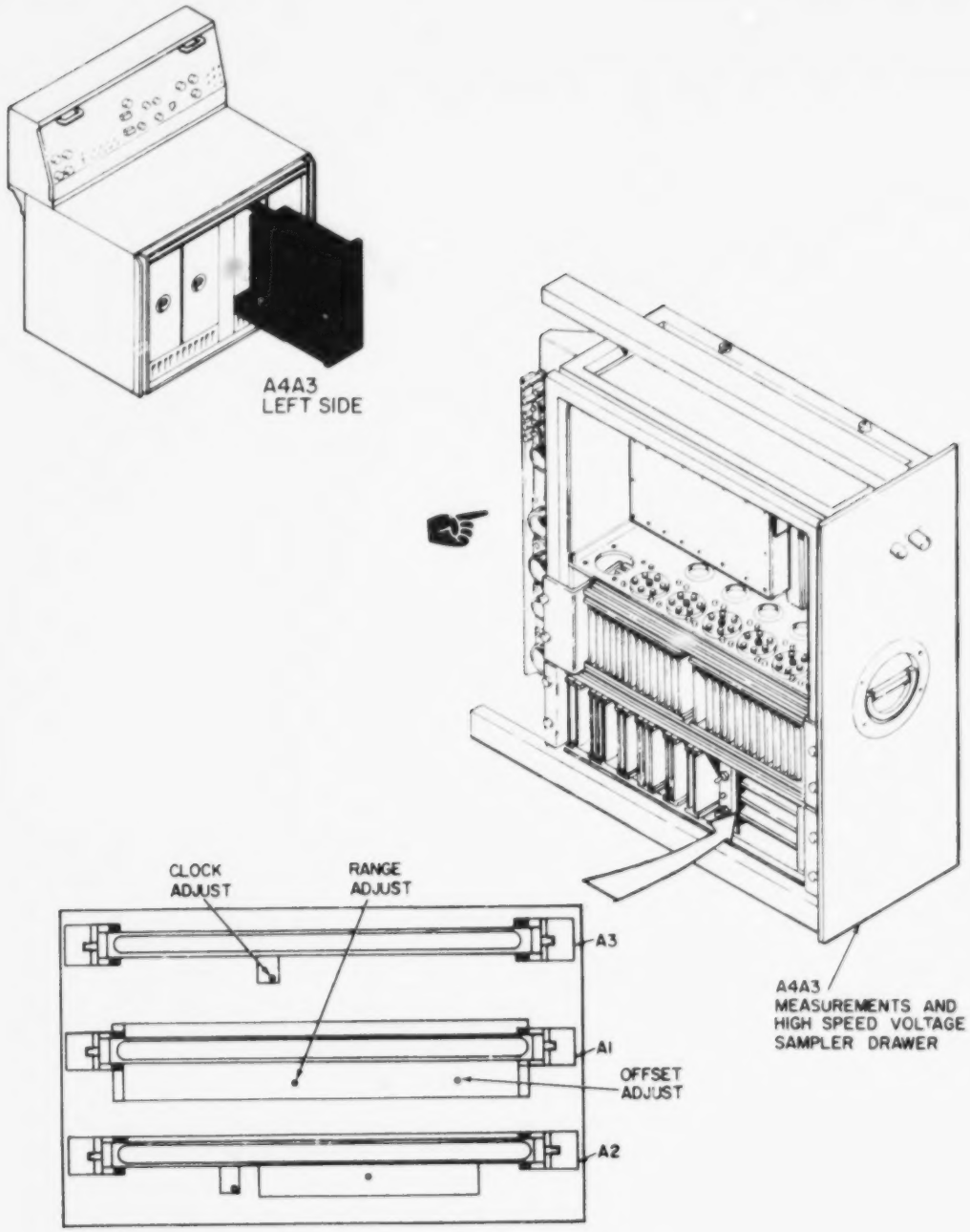


Figure 4-1. Location of Measurements No. 2 A4A3A2 Alignment Adjustments (Sheet 1 of 3)

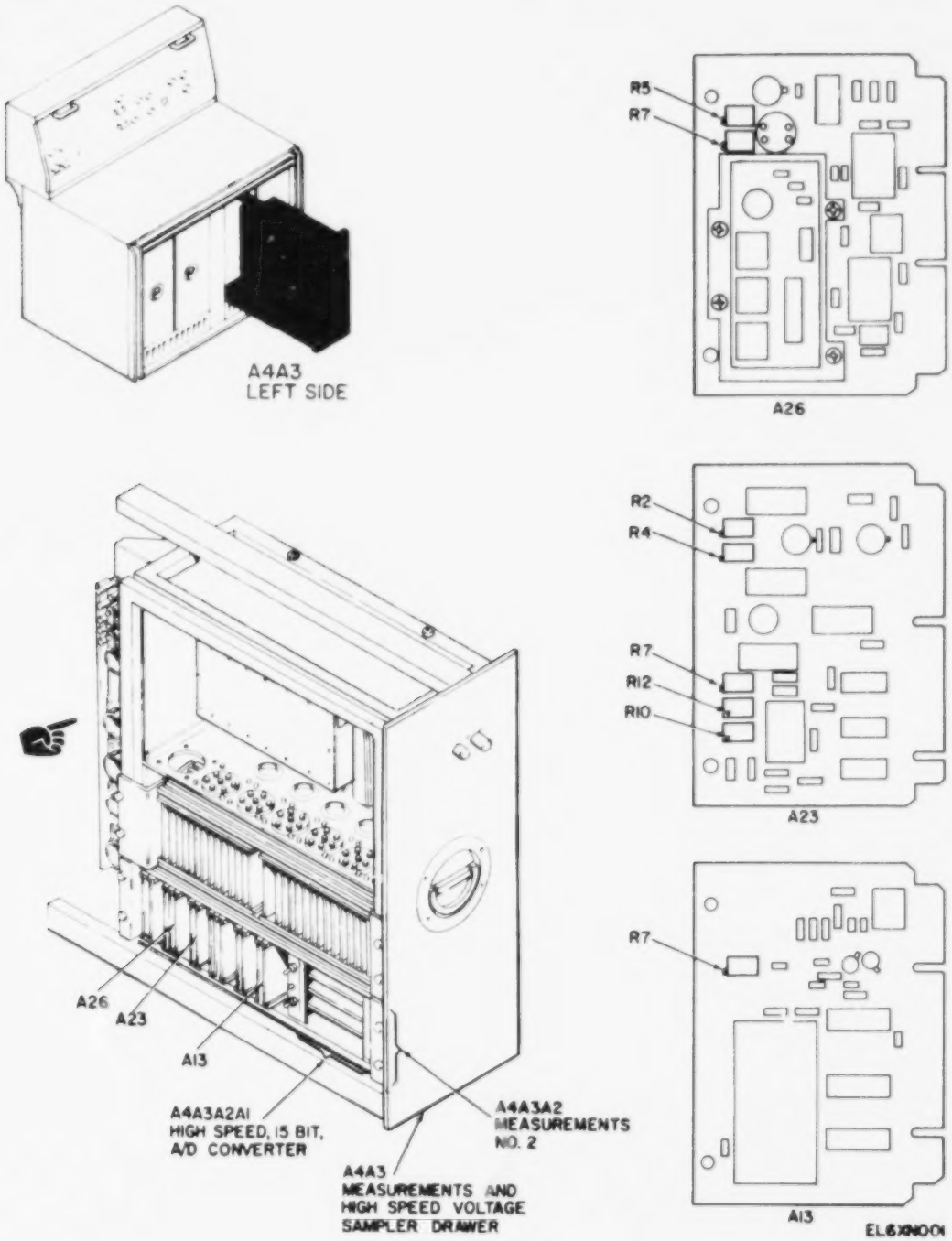


Figure 4-1. Location of Measurements No. 2 A4A3A2 Alignment Adjustments (Sheet 2 of 3)

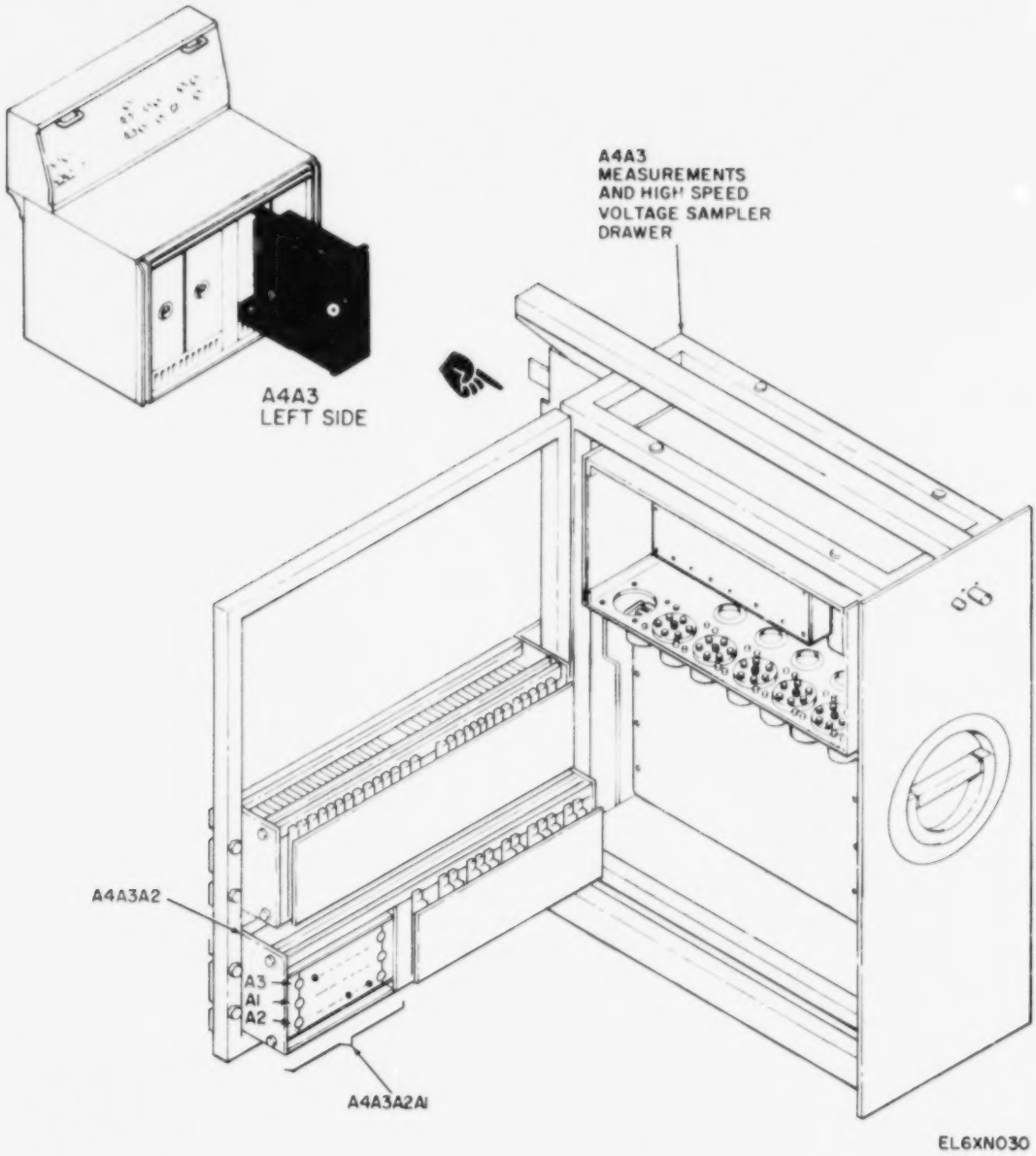


Figure 4-1. Location of Measurements No. 2 A4A3A2 Alignment Adjustments (Sheet 3 of 3)

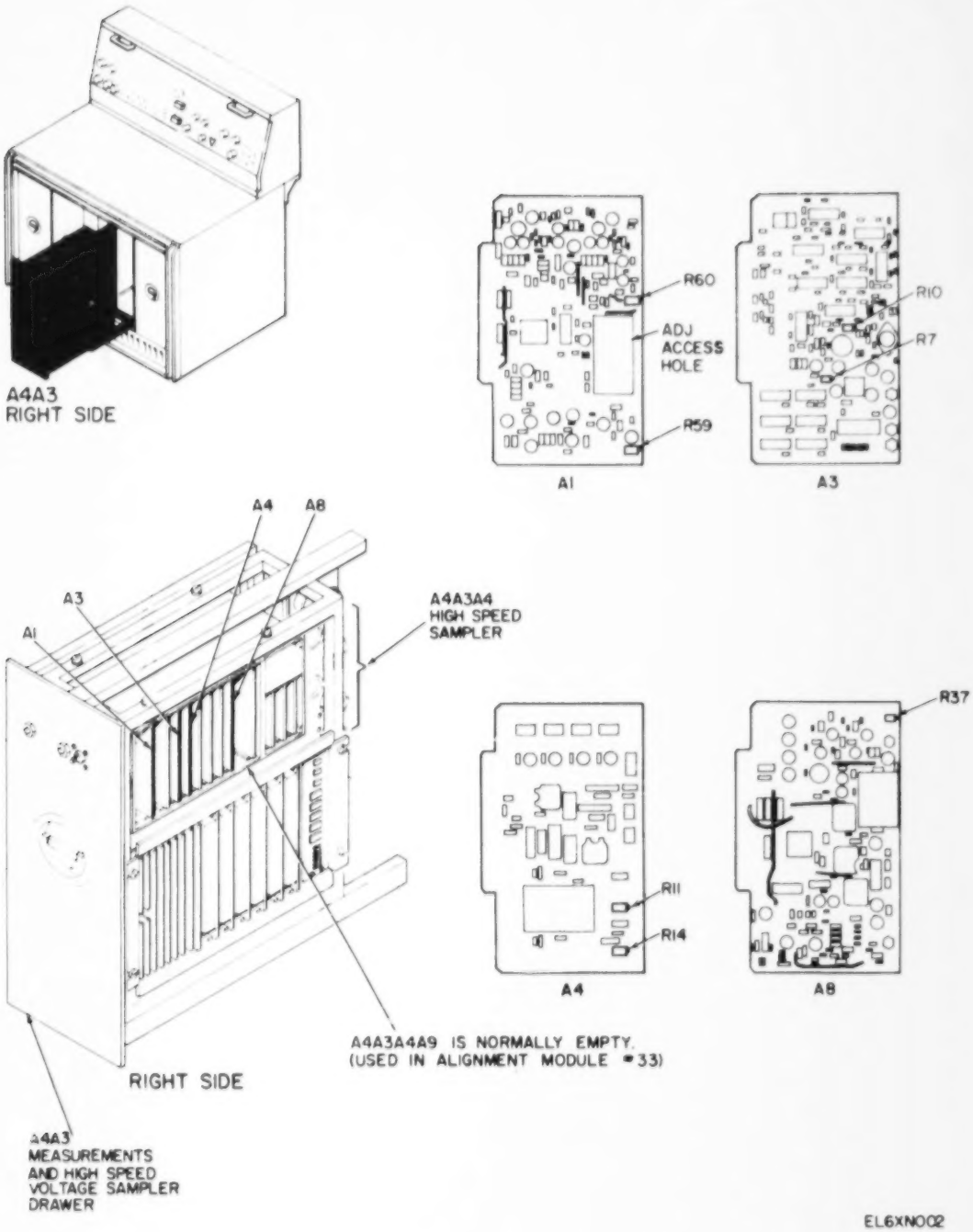


Figure 4-2. Location of High-Speed Sampler A4A3A4 Alignment Adjustments

Figure 4-3. Deleted

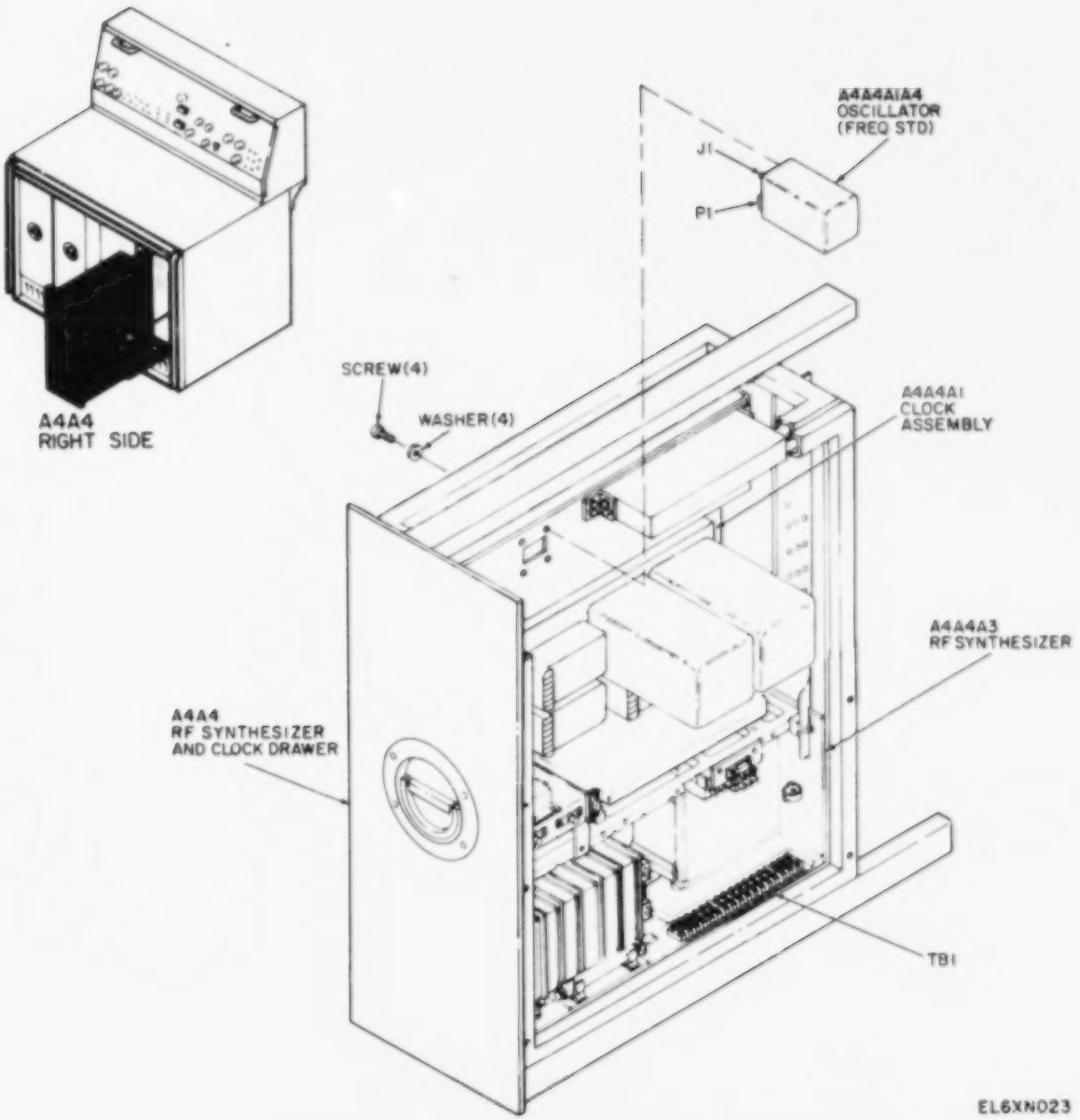


Figure 4-4. Location and Removal/Replacement of Oscillator A4A4A1A4

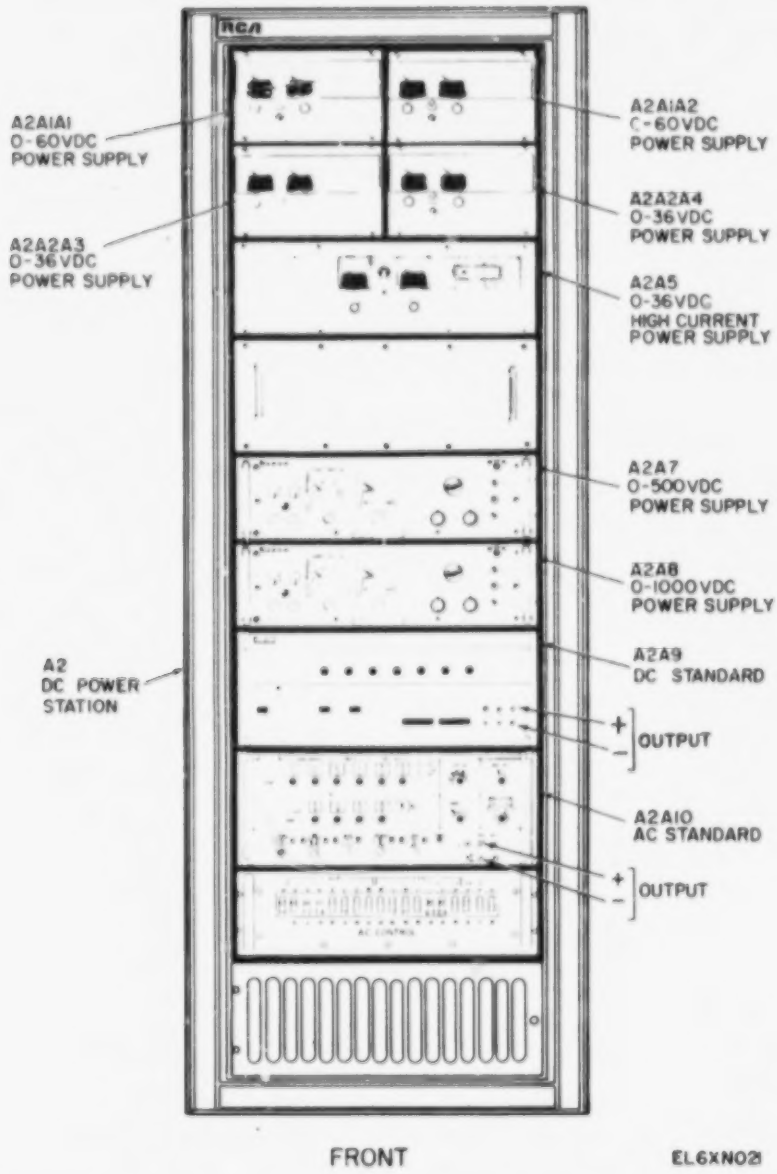


Figure 4-5. Location of Power Supplies A2A1PS1, A2A1PS2, A2A2PS3, A2A2PS4, A2A5, A2A7, and A2A8; DC Standard A2A9; and AC Standard A2A10

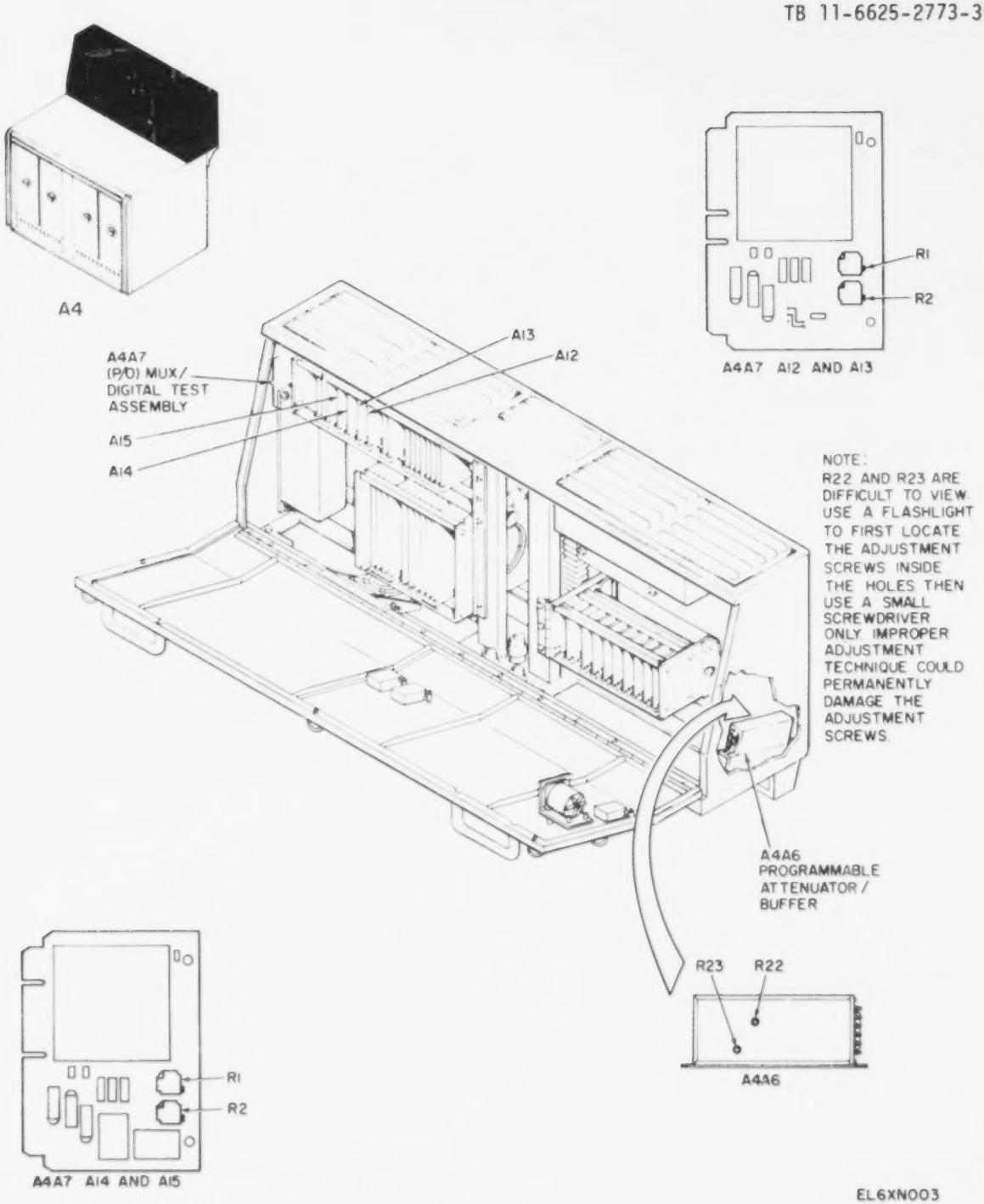


Figure 4-6. Location of Programmable Attenuator/Buffer A4A6 and (p/o) Mux/Digital Test Assembly A4A7 Alignment Adjustments

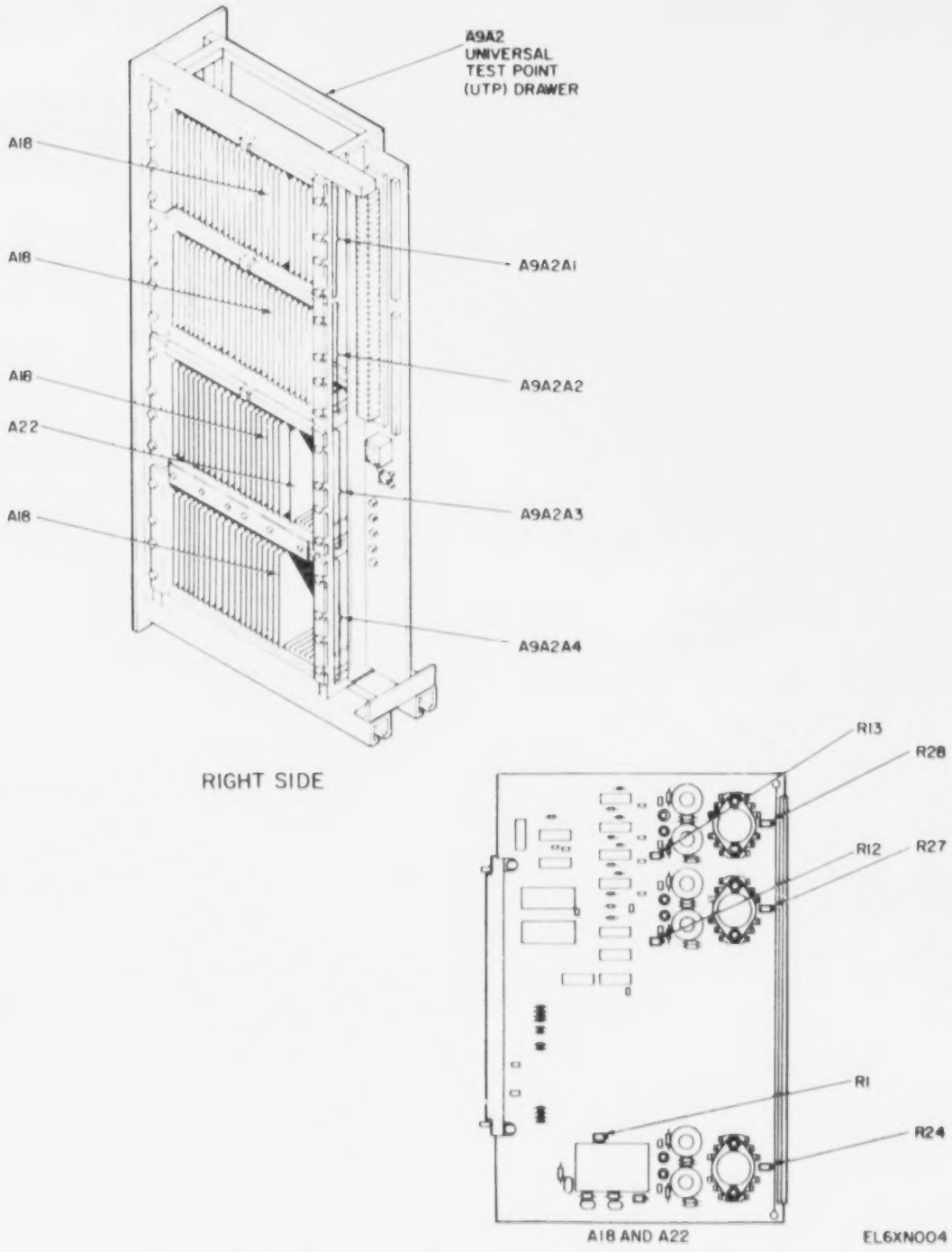


Figure 4-7. Location of Assemblies A9A2A1 through A9A2A4 Alignment Adjustments

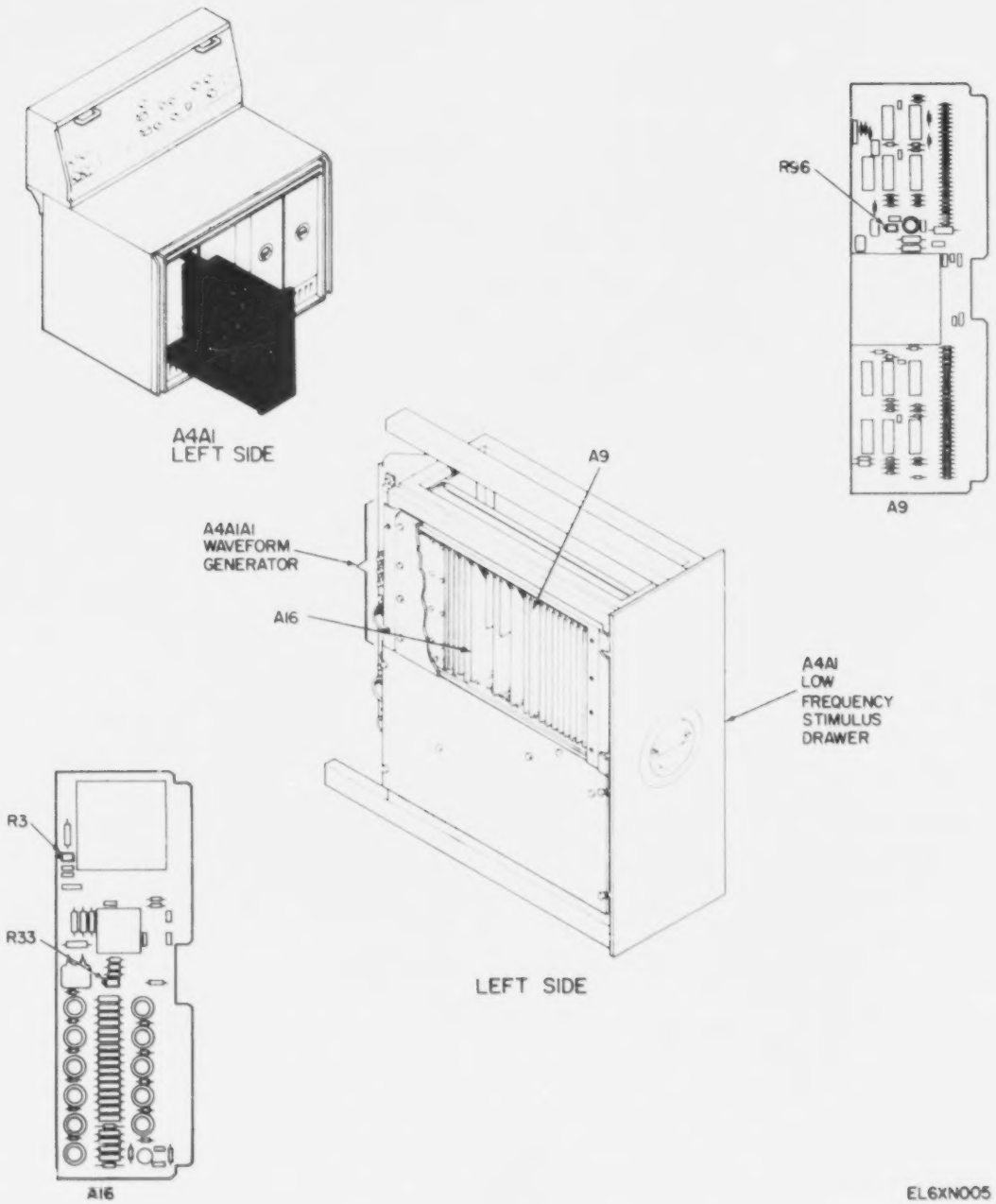
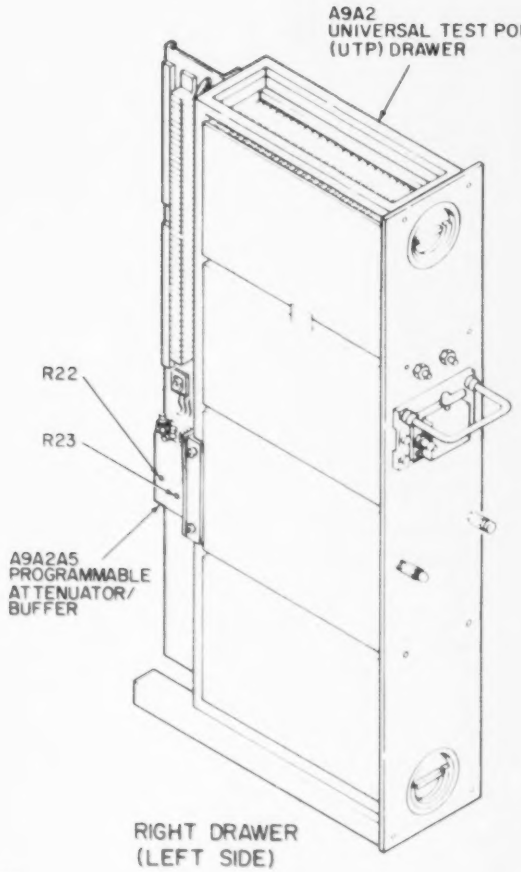


Figure 4-8. Location of Waveform Generator A4A1A1 Alignment Adjustments



NOTE R22 AND R23 ARE DIFFICULT TO VIEW USE A FLASHLIGHT TO FIRST LOCATE THE ADJUSTMENT SCREWS INSIDE THE HOLES. THEN USE A SMALL SCREWDRIVER ONLY. IMPROPER ADJUSTMENT TECHNIQUE COULD PERMANENTLY DAMAGE THE ADJUSTMENT SCREWS.

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Figure 4-9. Location of Programmable Attenuator/ Buffer A9A2A5 Alignment Adjustments

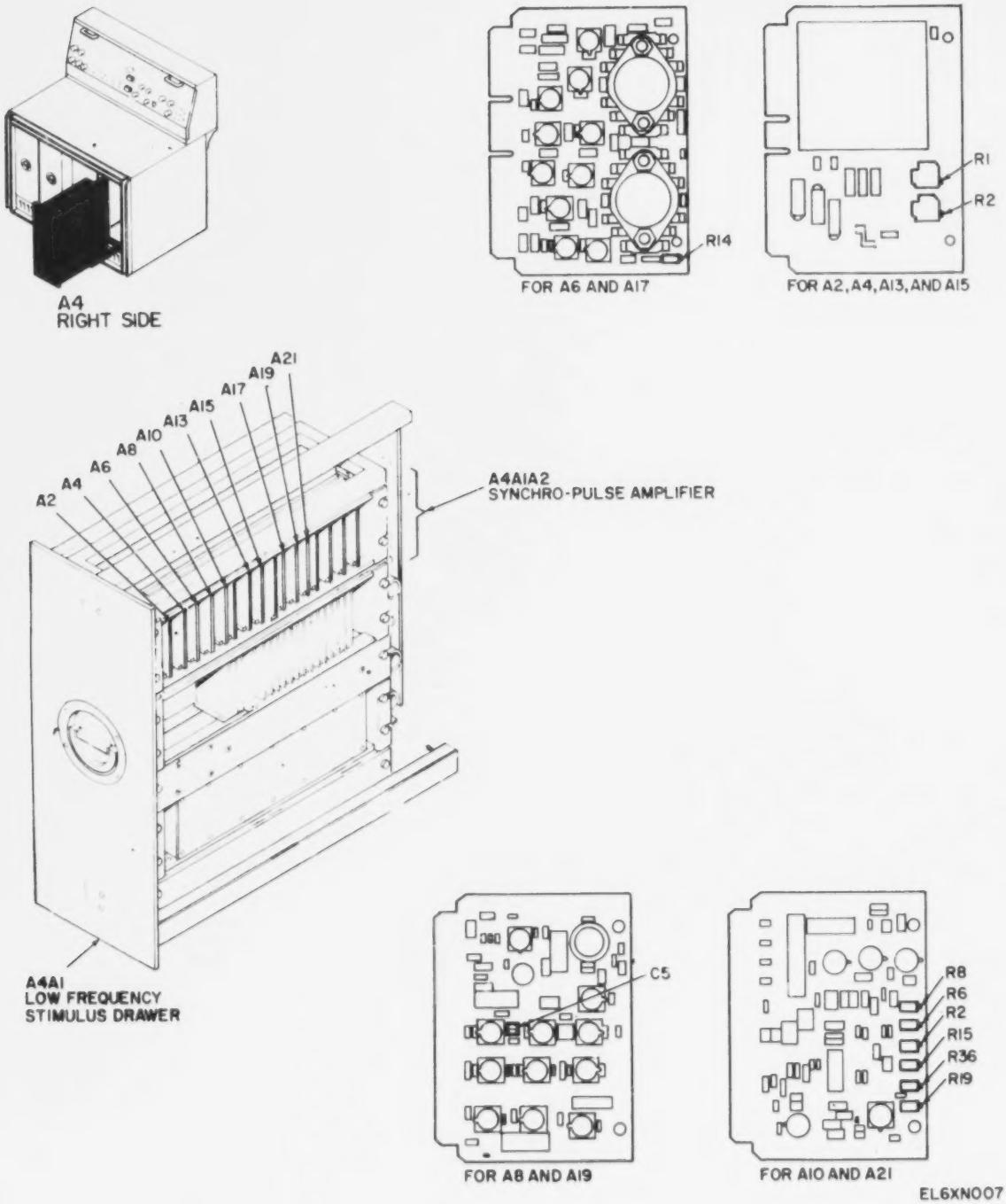
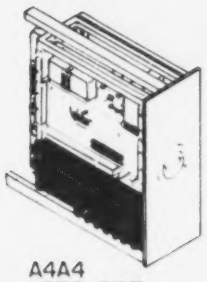
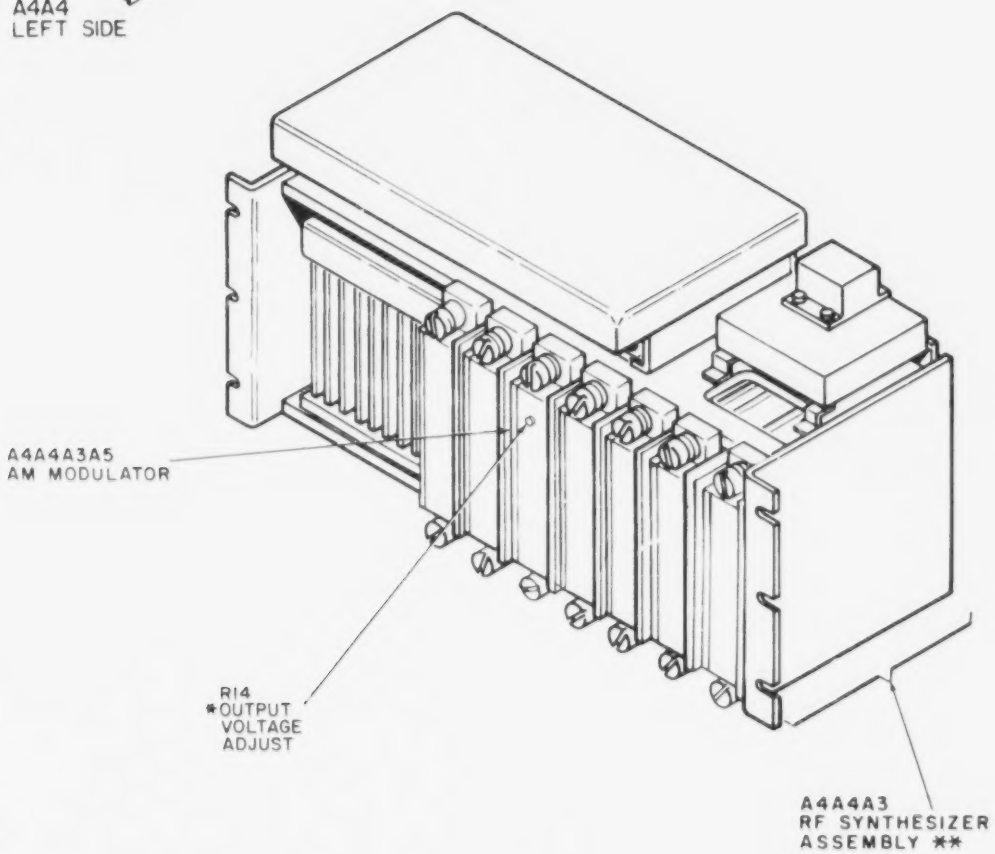


Figure 4-10. Location of Synchro-Pulse Amplifier A4A1A2 Alignment Adjustments



A4A4
LEFT SIDE



NOTES:
*REMOVE SCREW FOR ACCESS TO ADJUSTMENT
**RF SYNTHESIZER SHOWN REMOVED FOR CLARITY

EL6XN024

Figure 4-11. Location of RF Synthesizer A4A4A3 Alignment Adjustments

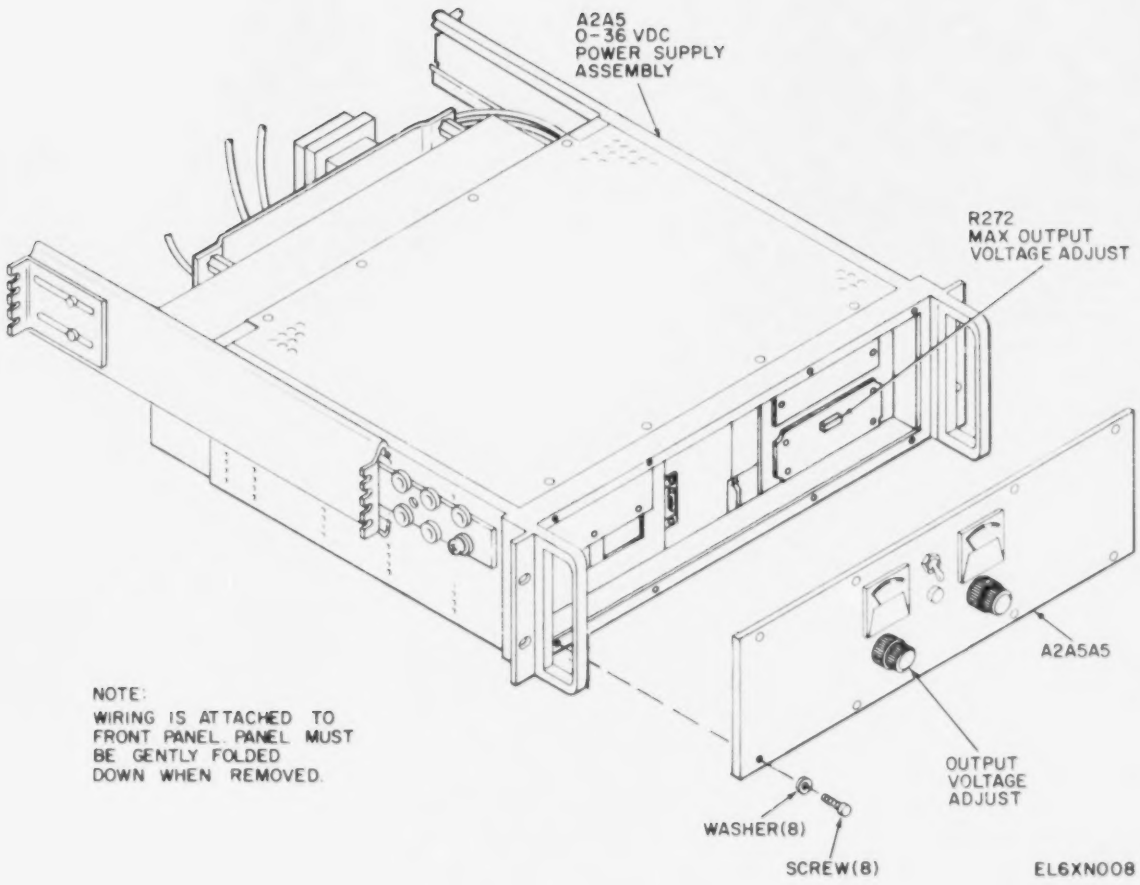


Figure 4-12. Location of 0-36 Vdc Power Supply Assembly, A2A5, Alignment Adjustments

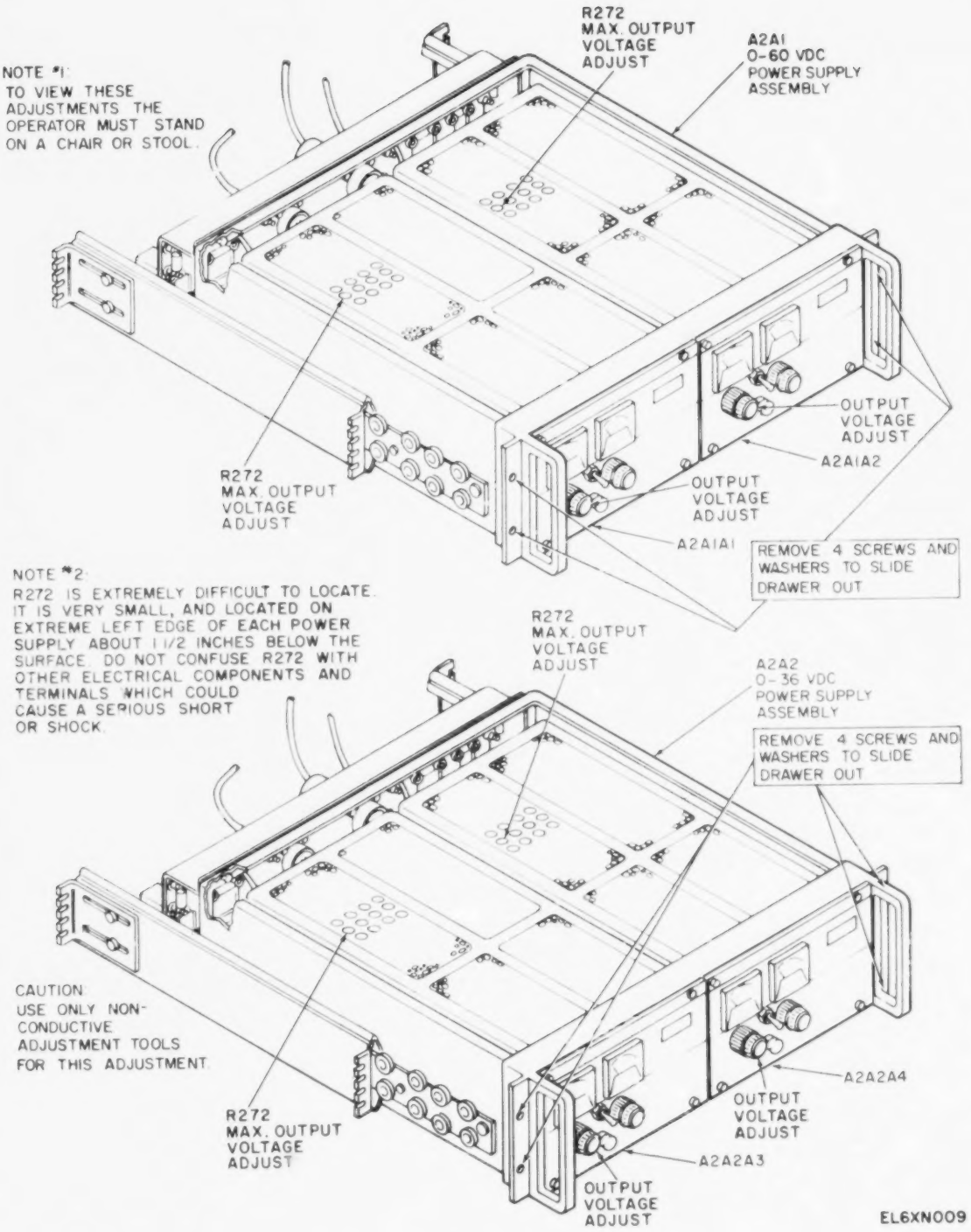


Figure 4-13. Location of 0-60 Vdc Power Supply Assembly A2A1 and 0-36 Vdc Power Supply Assembly A2A2 Alignment Adjustments

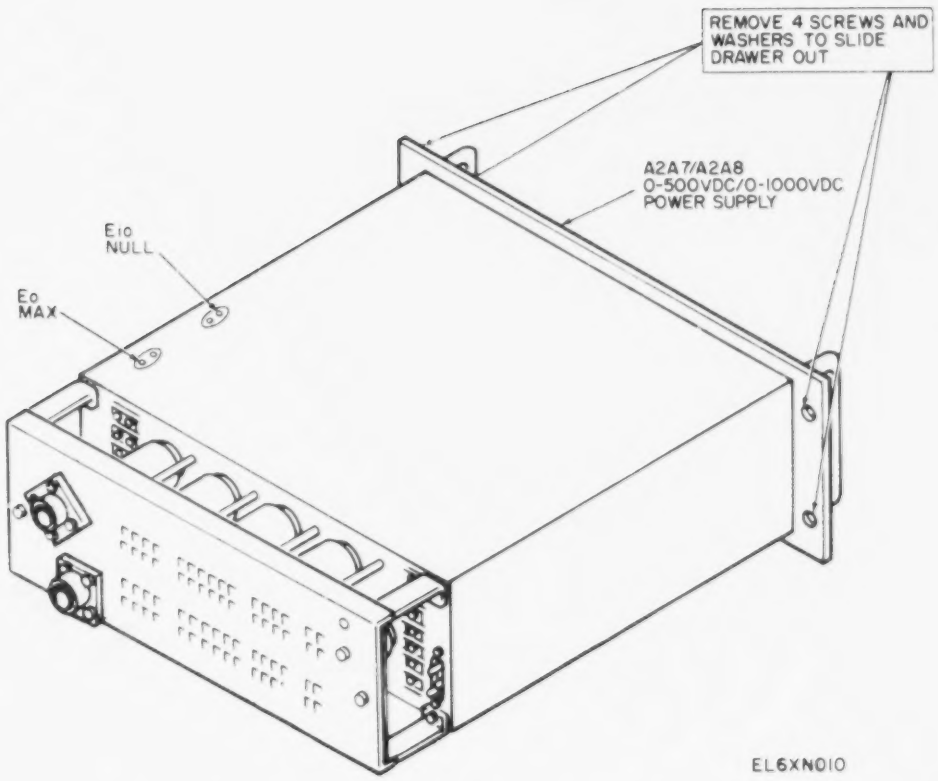


Figure 4-14. Location of 0-500 Vdc and 0-1000 Vdc Power Supply Assemblies A2A7 and A2A8 Alignment Adjustments

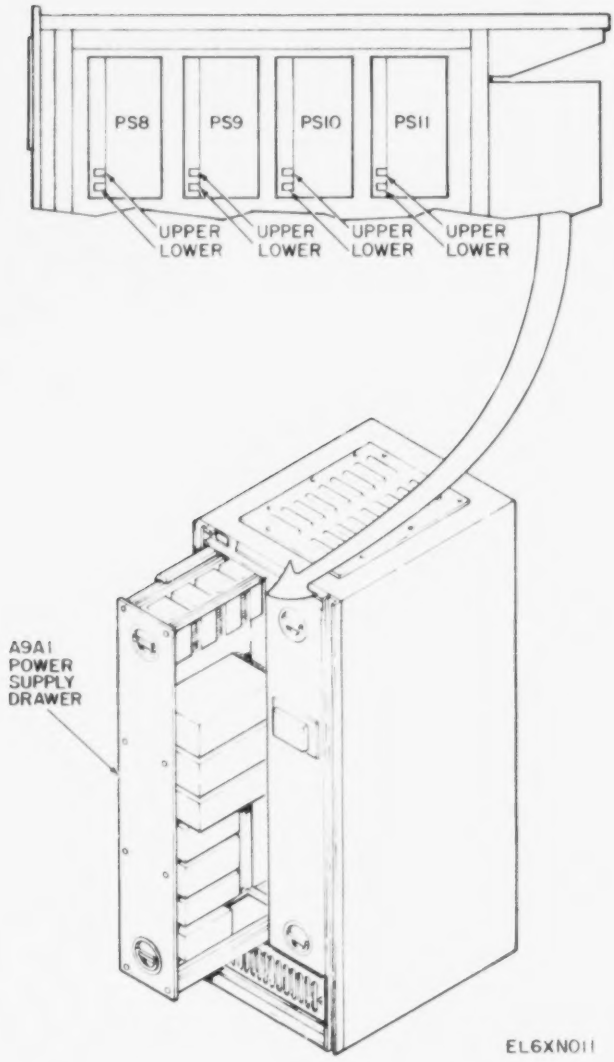


Figure 4-15. Location of Power Supplies A9A1PS8 through A9A1PS11 Alignment Adjustments

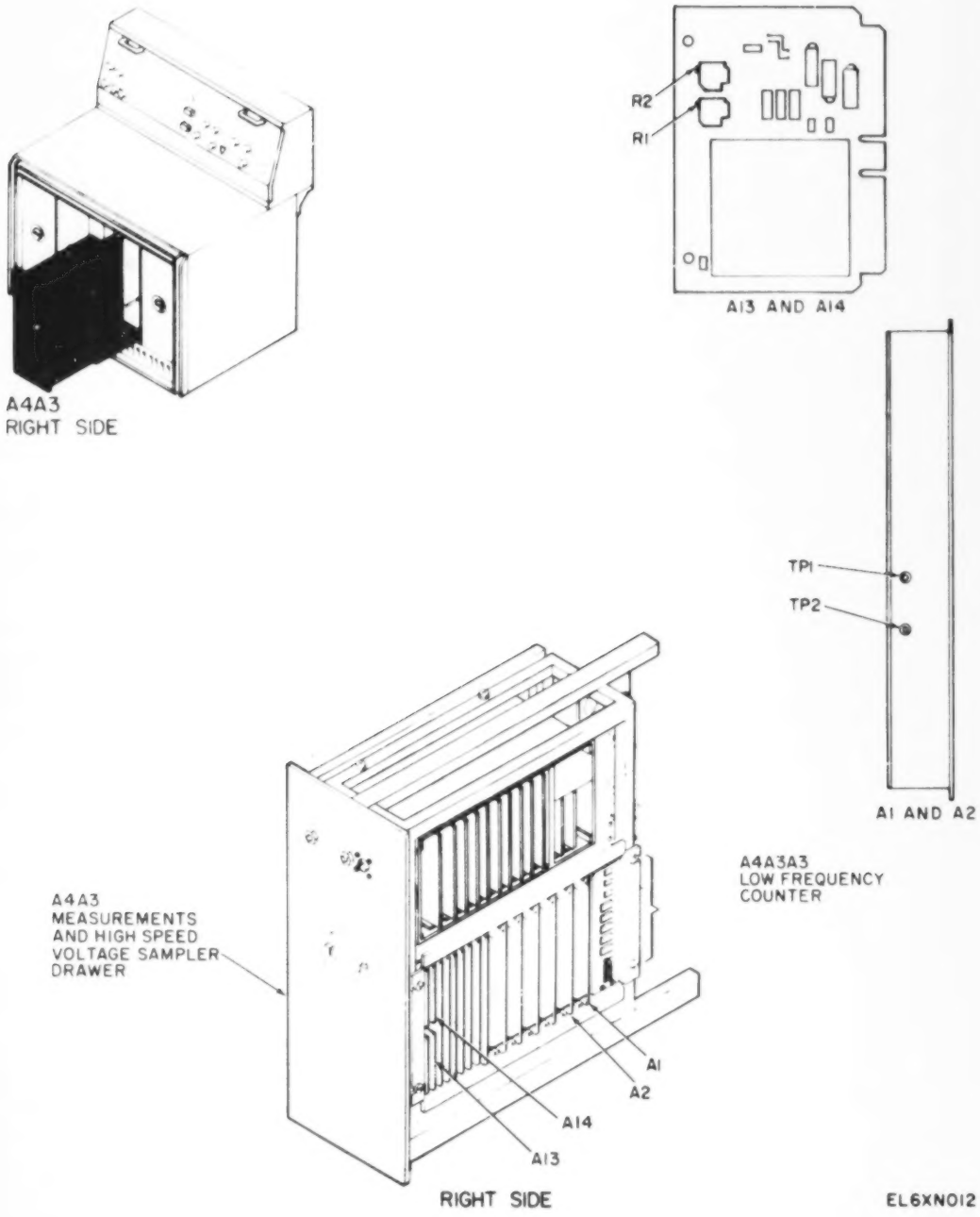


Figure 4-16. Location of Low Frequency Counter A4A3A3 Alignment Adjustments

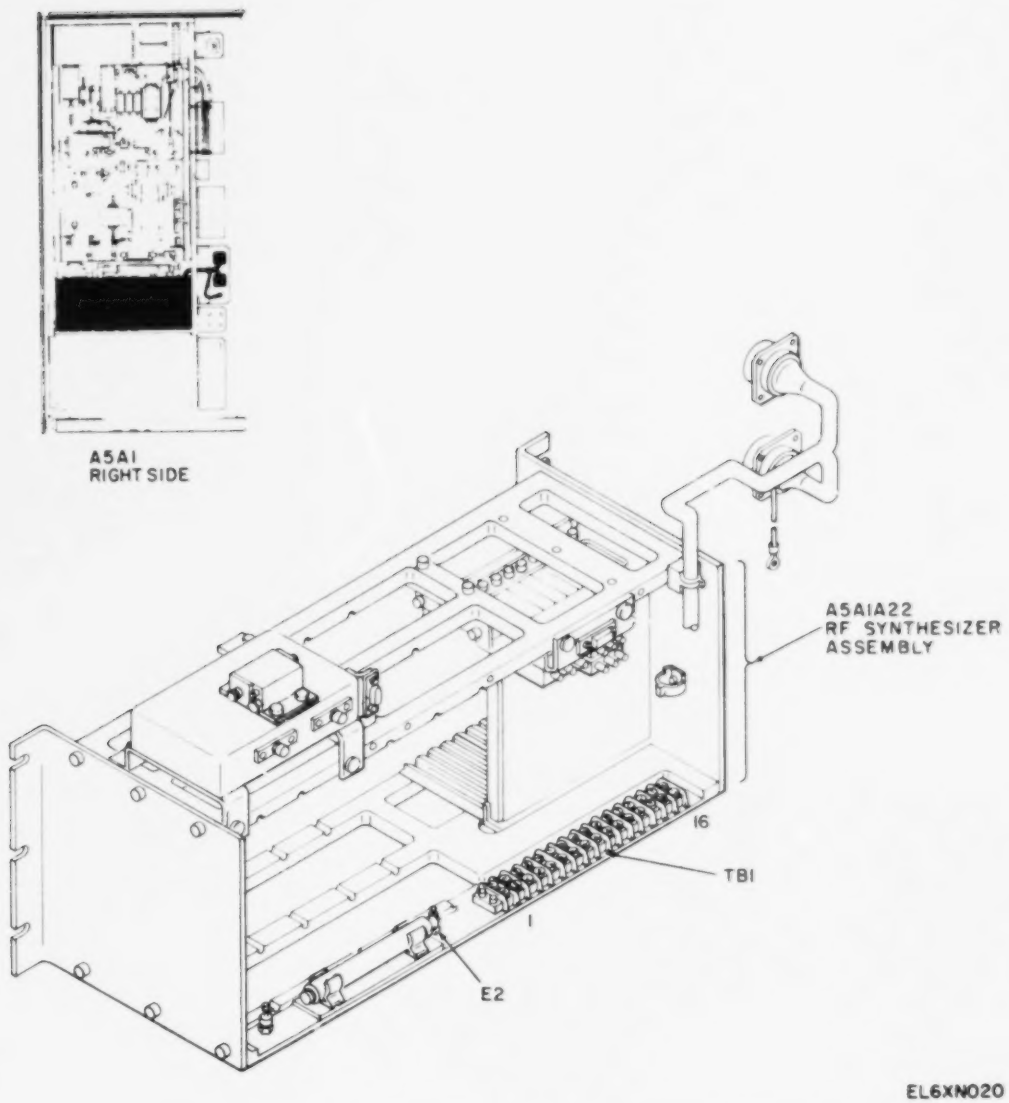


Figure 4-17. Location of RF Synthesizer Assembly A5A1A22 Test Points

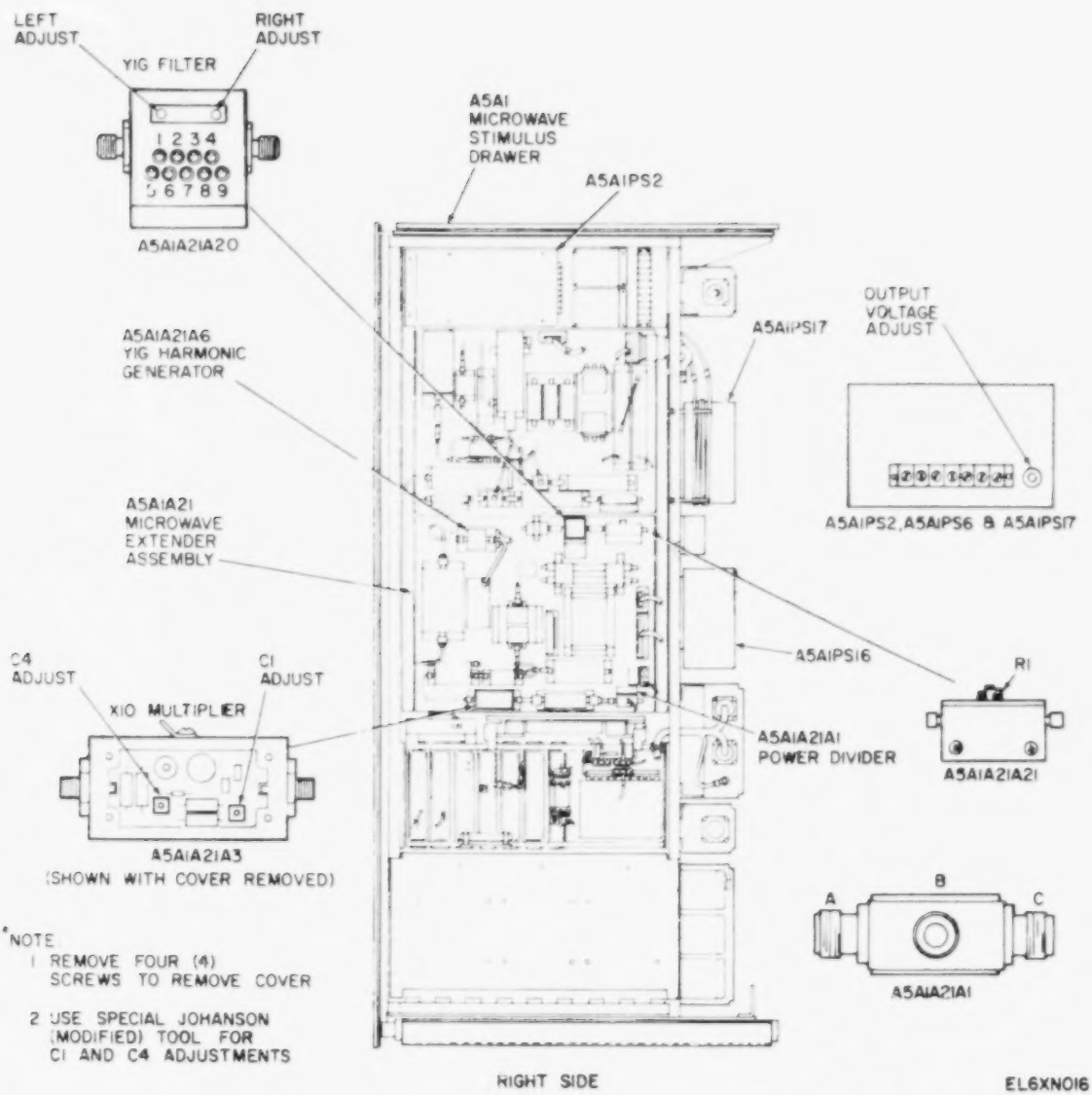
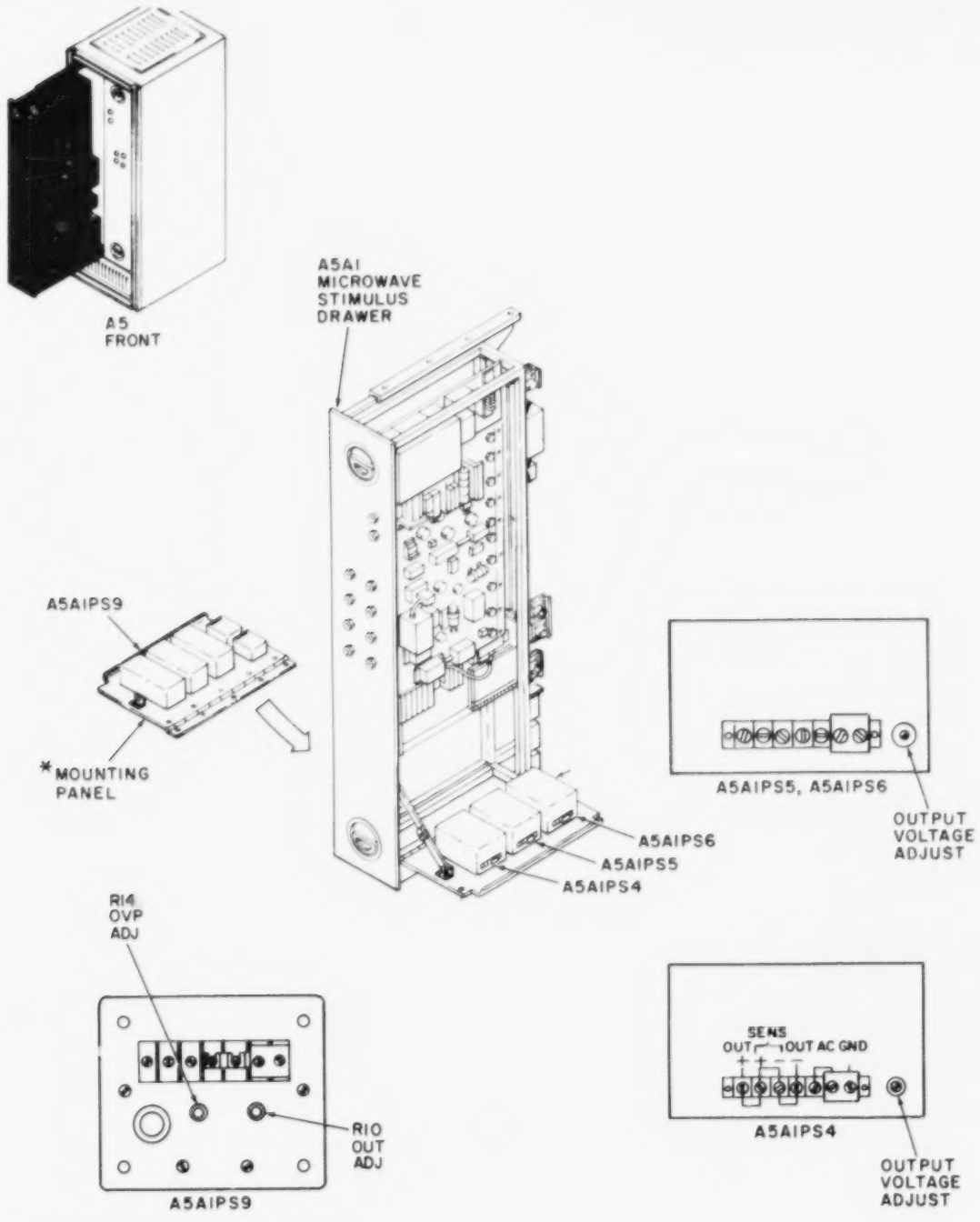


Figure 4-18. Location of Power Supplies A5A1PS2, A5A1PS16 and A5A1PS17; and Microwave Extender Assembly A5A1A21 Alignment Adjustments



*MOUNTING PANEL SHOWN REMOVED FROM DRAWER FOR CLARITY.

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Figure 4-19. Location of Power Supplies A5A1PS4, A5A1PS5, A5A1PS6, and A5A1PS9 Alignment Adjustments

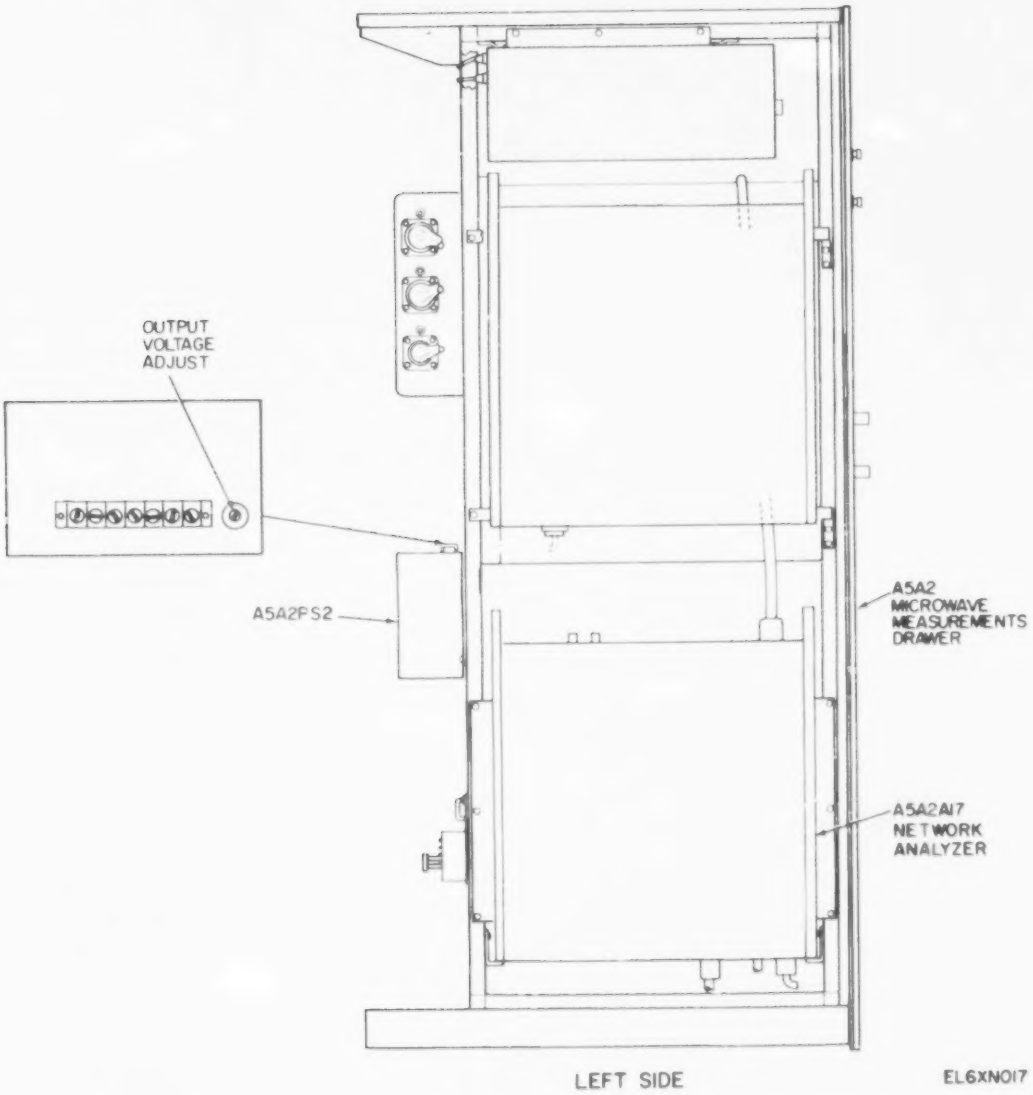


Figure 4-20. Location of Network Analyzer Assembly A5A2A17 and of Power Supply A5A2PS2 Alignment Adjustments

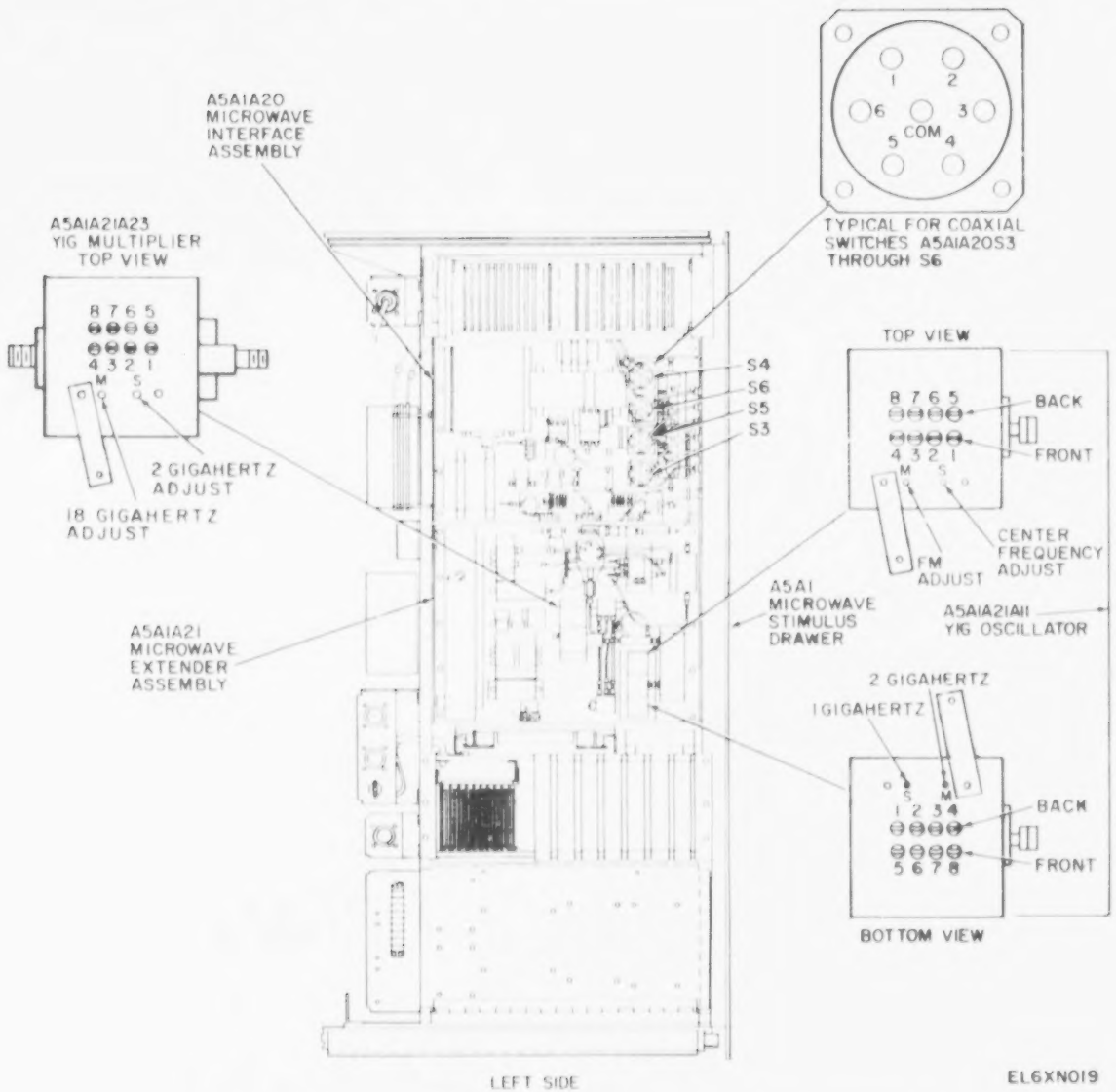


Figure 4-21. Location of Microwave Interface Assembly A5A1A20 and Microwave Extender Assembly A5A1A21 Alignment Adjustments; and Coaxial Switches A5A1A20S3 through A5A1A20S6 Connectors

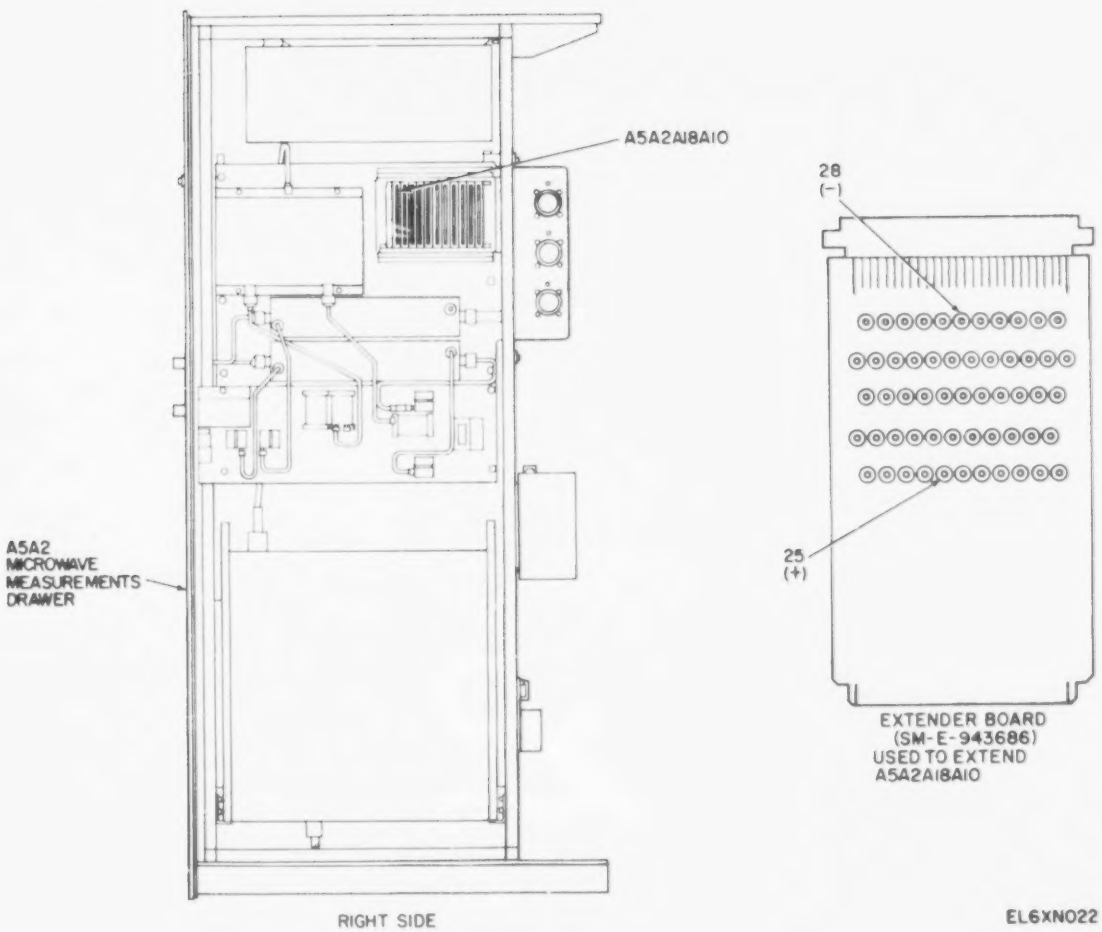


Figure 4-22. Location of Control Card Chassis Assembly A5A2A18A10; and Extender Board SM-E-943686 Test Points

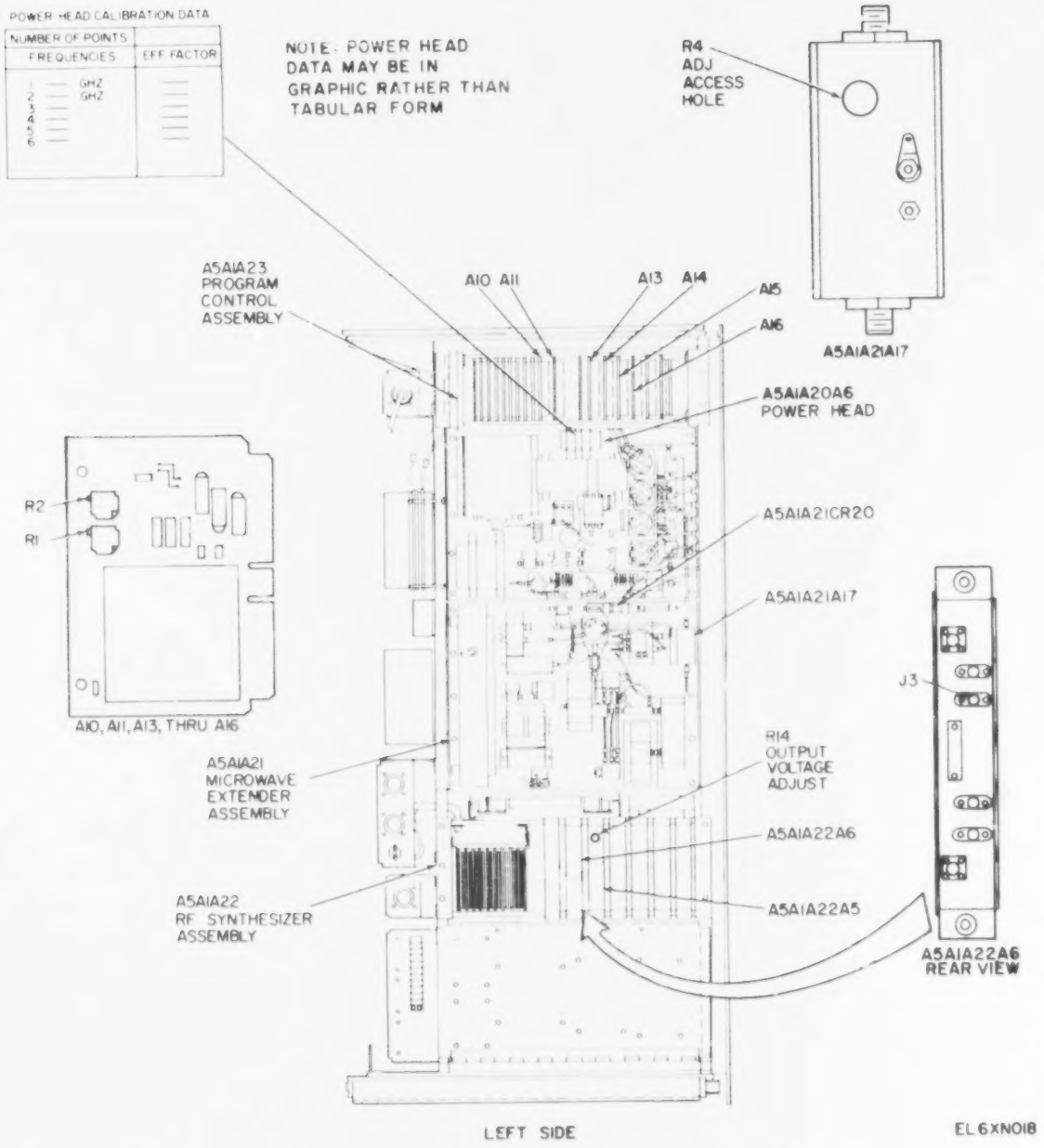
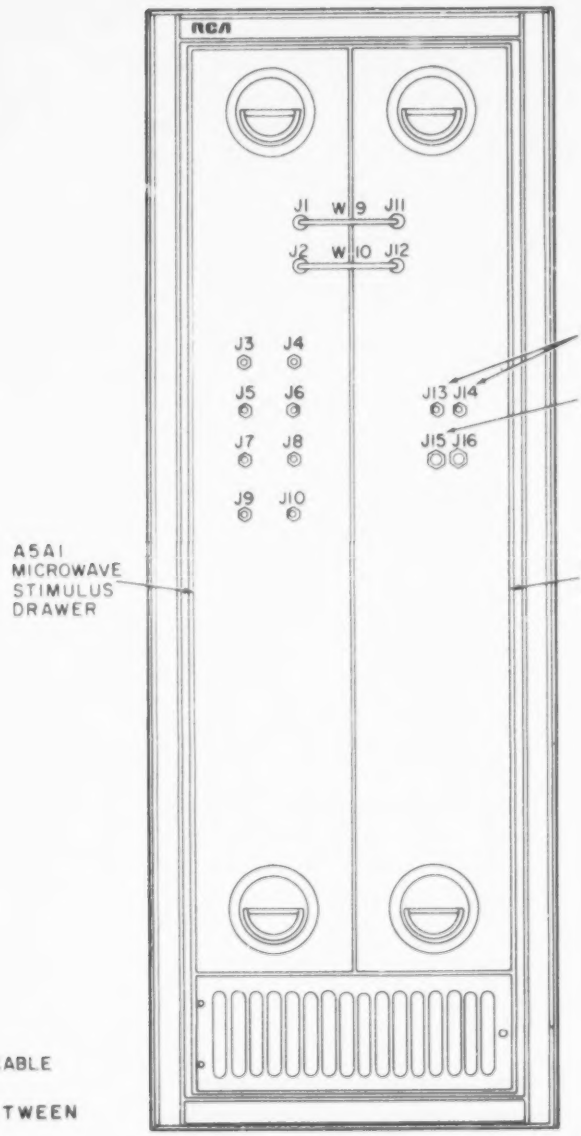


Figure 4-23. Location of Microwave Extender Assembly A5A1A21, RF Synthesizer Assembly A5A1A22, and Program Control Assembly A5A1A23 Alignment Adjustments



NOTE 1:
COAXIAL TEST CABLE
(SM-D-869606)
CONNECTED BETWEEN
J13 AND J14.

NOTE 2:
COAXIAL (TYPE N) FIXED SHORT
(SM-D-869608)
CONNECTED TO J15.

EL6XN026

Figure 4-24. Location of Microwave Stimulus Drawer A5A1 and Microwave Measurements Drawer A5A2 Front Panel Connectors

By Order of the Secretary of the Army:

EDWARD C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

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Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/[illegible]-76

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of [illegible] knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. + 24 VDC is the input voltage.

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
SSG I. M. DeSpiritof 999-1776

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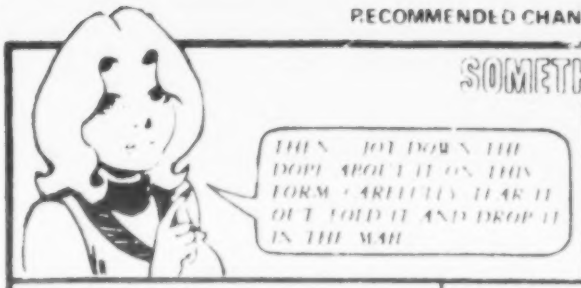

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

TEMPERATURE

$5/9\ (^0F - 32) = {}^0C$
212^0 Fahrenheit is equivalent to 100^0 Celsius
90^0 Fahrenheit is equivalent to 32.2^0 Celsius
32^0 Fahrenheit is equivalent to 0^0 Celsius
$9/5\ C^0 + 32 = F^0$

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

TA089991